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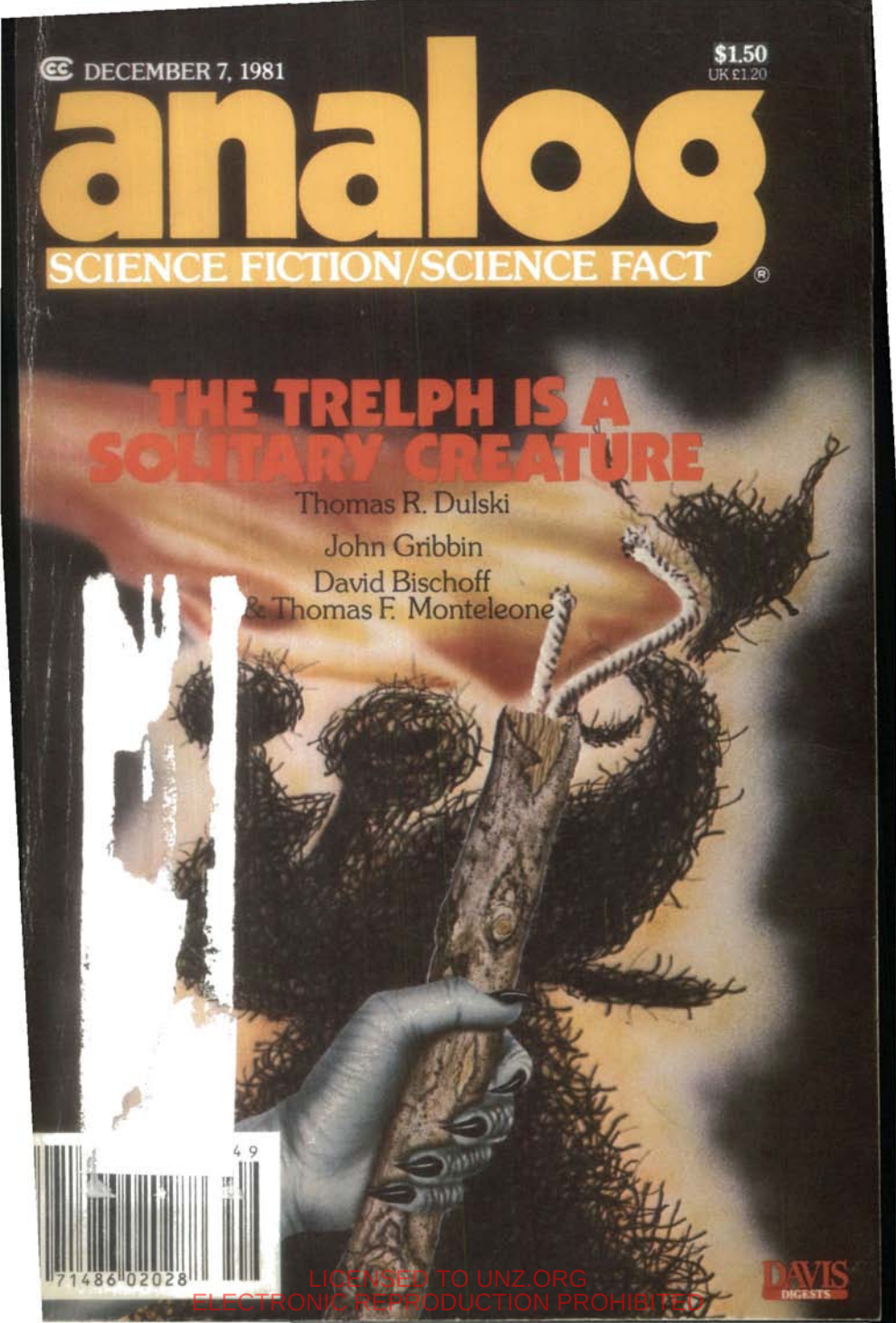

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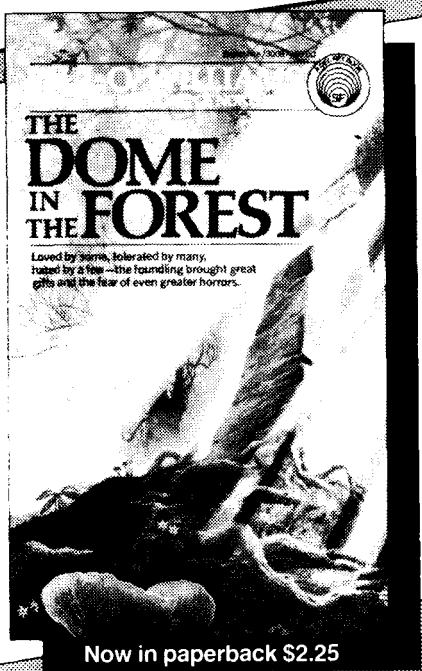
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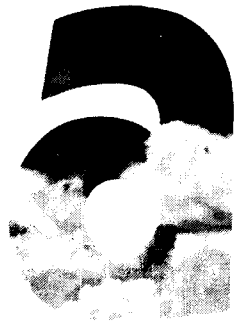

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Editorial

THE ONE-WAY PENDULUM

by

Stanley Schmidt

There's nothing new in the observation that popular opinion and public policy on just about any issue tend to oscillate between extremes, "moderation" occurring only as a transient on the way from one extreme to another. Therefore there should be nothing surprising in the present spate of environment-be-damned attitudes in various circles, conspicuously including government. The sixties and early seventies, after all, brought an unusual spate of *pro*-environment activism, with a great rush to Clean Up Pollution and Save the Ecology.

Personally, having a long-standing and deep-rooted fondness for wild places and the things that live in them, and distaste for the way many humans treated their surroundings, I welcomed that trend—up to a point. I was a little chagrined to see it carried to such unreasoning lengths as maintaining that *every* species of plant and animal was equally important to the ecosystem, or that every perturbation of the environment was equally important and absolutely unacceptable. Such claims simply don't hold up under factual scrutiny, and they undermine the credibility of those who make them. A reaction was inevitable, and now it is upon us.

However, with so much of that reaction taking the form of concrete and aggressively presented policy proposals by such people as James G. Watt, Secretary of the Interior, I see an urgent need to remind ourselves—and them—that if a pendulum swings too far, it may hit something and do so much damage to the structure supporting it that it *can't* return. I can always hope that my reasons for writing will no longer be with us by the time you read this, but I dare not assume it.

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The policies under discussion, abandoning conservation in favor of wholesale exploitation, may well be an example of a pendulum which, once released, can never be called back. Some, such as halting the acquisition of new wilderness and park lands, have been defended on grounds of "budget-cutting." Now, I always favor cutting unnecessary expenditures—but I also favor giving a modicum of thought to the distinction between the necessary and the unnecessary. I shall not dwell on the ludicrous contrast between the paltry savings to be achieved here (in terms of the total federal budget) and the enormous *increases* being pursued headlong in other parts of the budget. That is not my main subject at the moment. Here I am more concerned with the outright irreversible *damage* which will be done by some of the policies proposed or already adopted—things like opening up existing wilderness areas to mining and drilling, weakening the already ineffective regulation of strip mining, and "studying" some national parks for possible abolition.

It is difficult for me to write calmly and dispassionately about these proposals. Wild lands have been too important a part of my own life and those of many of the people I most care about. Too many of my fondest memories are set in deep backcountry, accessible only by days of walking. I have driven too often through the garishly scarred Cumberland Mountains of northern Tennessee. I have seen too many special places marred irreparably—and unnecessarily.

Aside from budget-cutting, the main justification given for the current exploitation fever seems to be the hysterical convictions that we *need* whatever oil, coal, ores, etc., lie under the presently protected lands, and we need them Right Now.

The more timid, "practical" argument against this claim is that we may need these resources even more in the future, and so should save them as long as possible, as "reserves." But there's a danger in this. As the present situation neatly demonstrates, if we say we'll save them "until we need them," it's always an easy temptation to say The Time Has Come. If we *really* want to save them, we'd better tell ourselves we're saving them *forever*, and mean it, and abandon that view only under the most desperately compelling need. If we're reasonably clever, that kind of need may never arise, and we really will be able to save the "reserves" indefinitely.

In the long run, the finite mineral deposits under wild land may not be the most valuable resource they hold. The most valuable contributions they can make may well be the "intangible" benefits of places which are wild and open and remind us of our origins. "Intangible" is an imprecise word which disturbs ledger-oriented minds; I suspect that a more advanced science of psychology could make it much less nebulous, but for now it will have to do. The fact that we cannot now quantify these values does not make them any less real or less important. James Watt doesn't understand them, evidently, but *that* doesn't make them less real or less important, either. They are very real and very important to me, and to a great

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many others—to a number, in fact, which has been growing so rapidly in recent years that we need *more*, not less, land to provide them. With more people using what we now have, the quality of experience available to any of them has already declined markedly—a fact to which I can attest both from extensive personal experience and from park and forest service reports.

If it came down to a choice between saving these areas and saving *Homo sapiens* literally, I would probably opt for survival. But I don't believe that's the choice we face, now or in the foreseeable future. Therefore I must oppose, as loudly as possible, embarking headlong on a destructive course from which there may be no return. To paraphrase Franklin D. Roosevelt, our most urgent problem is hysteria—*especially* in government.

What *are* the choices we face? Either we can find new sources of energy and materials, or we can suffer a gradual and continuing erosion of our standard of living.

Some people would cheerfully accept the declining standard of living—or think they would, having never had to do without such amenities as automobiles and washing machines. I won't; I freely admit I like automobiles and washing machines a lot better than the alternatives. I see neither advantage nor virtue in drudgery, or in being confined to one tiny spot on one planet (or dependent on someone else for the means to go elsewhere).

If we want to keep (and extend) the advantages of technology, we will have to find and develop new sources of energy and materials. We can start by finding and adopting more efficient and less wasteful ways to use what we have, including good workmanship and planned recycling. This is a good idea in any case, but it is not enough. We will still need new sources, and quite a few options—*nonexclusive* options—spring

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readily to mind:

(a) *Unplanned* recycling—i.e., recycling things which were not designed with easy recycling in mind.

(b) New foreign sources—i.e., buying from other countries.

(c) New domestic sources—conspicuously including the ones I've been talking about (even though there's evidence that sources already available are not being adequately used).

(d) New *really* foreign sources—i.e., off-Earth.

(e) New *types* of sources.

Quite likely we'll have to pursue all of these concurrently, but some are more appealing than others. Choice (a) is, at present, expensive and unappetizing. "Trash miner" may someday be an essential and highly regarded occupation, but most people would rather try other things first.

(b) is possible but full of pitfalls. Need I say more than "OPEC"?

(c) avoids the traps of (b) and is one of the more attractive possibilities in places where it doesn't conflict excessively with other considerations. But in many cases it does. Converting especially attractive wilderness areas to mines and oil fields involves the sacrifice of irretrievables of great intangible value to many people. Extinct species are hard to revive; radically disturbed ecosystems do establish new quasi-balances, but the new is never the same as the old, and it's seldom clearly superior. (Consider a typical urban vacant lot, for example.) Those of us to whom these irretrievables matter are not willing to sacrifice them to those unable to grasp them, especially when alternative solutions to the real problems exist.

And they *do* exist.

Moreover, hacking away at wildernesses and parks is not a long-range solution—at best, it merely buys a little time. It may even *delay* long-range solutions by producing a false sense that "something is being done," so that people don't bother working on the approaches with real long-range potential.

Which are (d) and (e). Both the development of alternate energy sources (such as the several using hydrogen, directly or indirectly), and the collection and use of materials from elsewhere in the solar system, are programs which, *unlike the proposed exploitation of protected lands*, can provide real, large-scale, long-term relief.

And which have never received the massive attention they need, and are now being downplayed still further by the present administration.

The "environmentalists" are right, that wild lands need to be saved in the largest doses possible—because they epitomize the one class of things which this planet can offer which space cannot. They are what Earth does best.

Therefore the need to save such lands is one of the strongest arguments, not only for the development of alternate energy sources, but for moving vigorously and immediately into space. Yes, even there there will be such a thing as environmental impact. I, for one, would hate to see Saturn destroyed to provide gas for balloons or even fuel for starships. But there is so much out there, so spread out, that a *lot* more can be

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removed before the impact becomes severe or even particularly noticeable.

And there is nothing out there so rich and intricate and inextricably bound up with man and his origins as those few remaining parcels of his home planet which have not yet been reshaped in his own myopic image. If we allow the pendulum of policy to swing so far that those are destroyed for the sake of a few billion barrels of oil and the like, we will never get them back. Perhaps only a few of us will realize what we have lost—and that everyone who let it happen has shared in a foolishness differing only in scale from that of selling Manhattan for $24 in trinkets.

But the more recent crime will have been by far the greater, and everyone will be poorer for it.

Yes, I know that fusion plants and O'Neill colonies and lunar and asteroid mines aren't ready to take over yet. But the problems aren't that acute yet, either. We do not have to take desperate measures by reflex. We do have time to achieve better, more rational solutions—*if* we start working on them, very seriously, now.

Energy alternatives do exist, even here, and most of the rest of what we need is Out There, in supplies far more adequate than on Earth. By getting it there, we can build a fantastic future, and still save at least a little of those special things which Earth alone can provide.

Maybe even long enough for James Watt to learn to understand them. ■

IT'S ANLAB TIME AGAIN! This issue completes 1981 for *Analog*; now it's your turn to let us know how we're doing. The authors are interested, I'm interested, and you should be interested—because your feedback about your likes and dislikes will have a second-order feedback effect on what we offer you in the future. So please vote. Here's how.

Look over all your copies of *Analog* dated 1981. (There will be an index in the next issue.) From them, pick your *three* favorites in *each* of the following categories: serial (and remember to count *Shuttle Down* here, although it began in 1980), novella/novelette (a *single* category) short story, science fact article, and cover. Then drop us a line listing your favorites in each category, in order of preference. We'll tabulate the votes and let you know how they came out.

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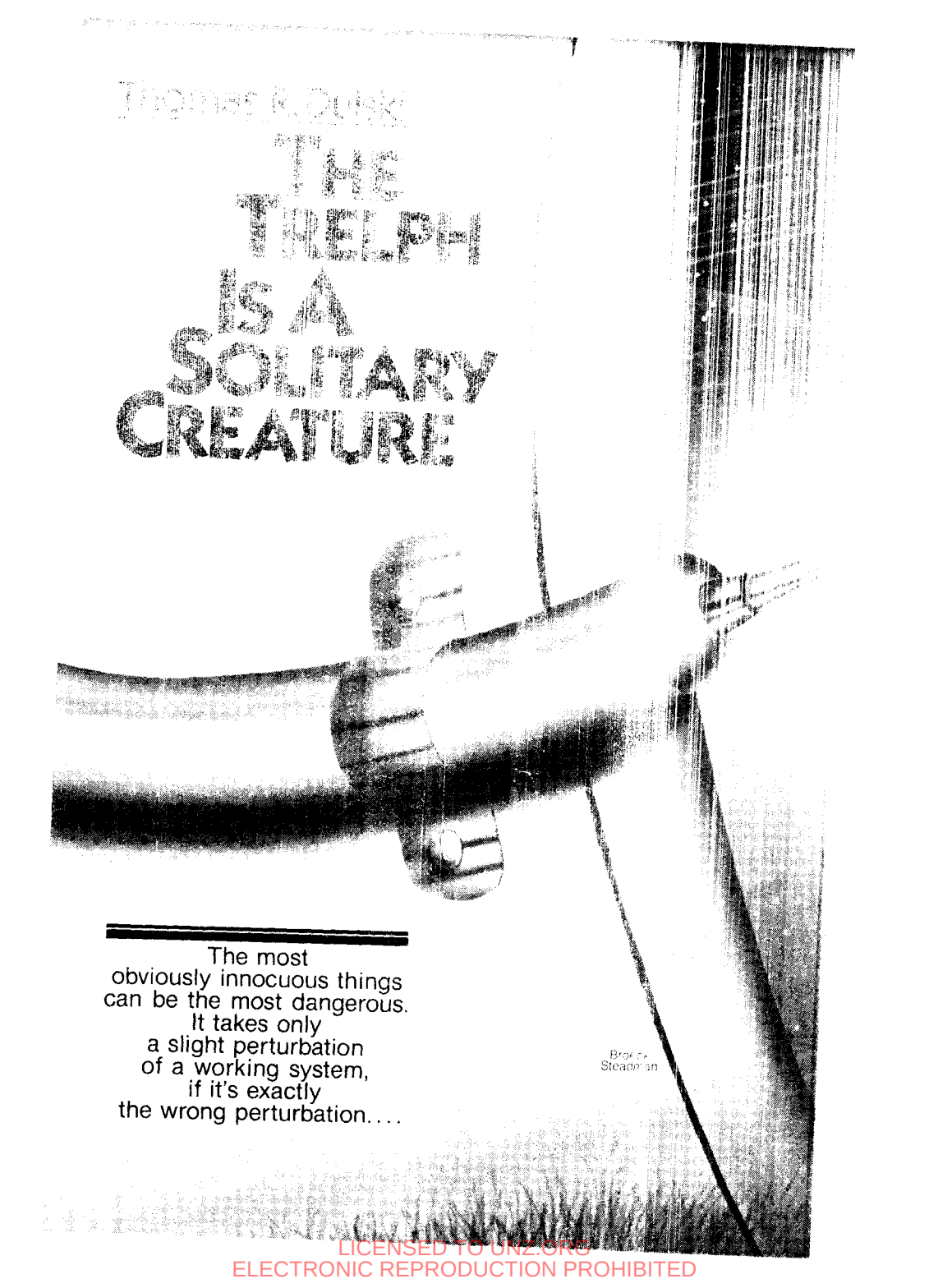

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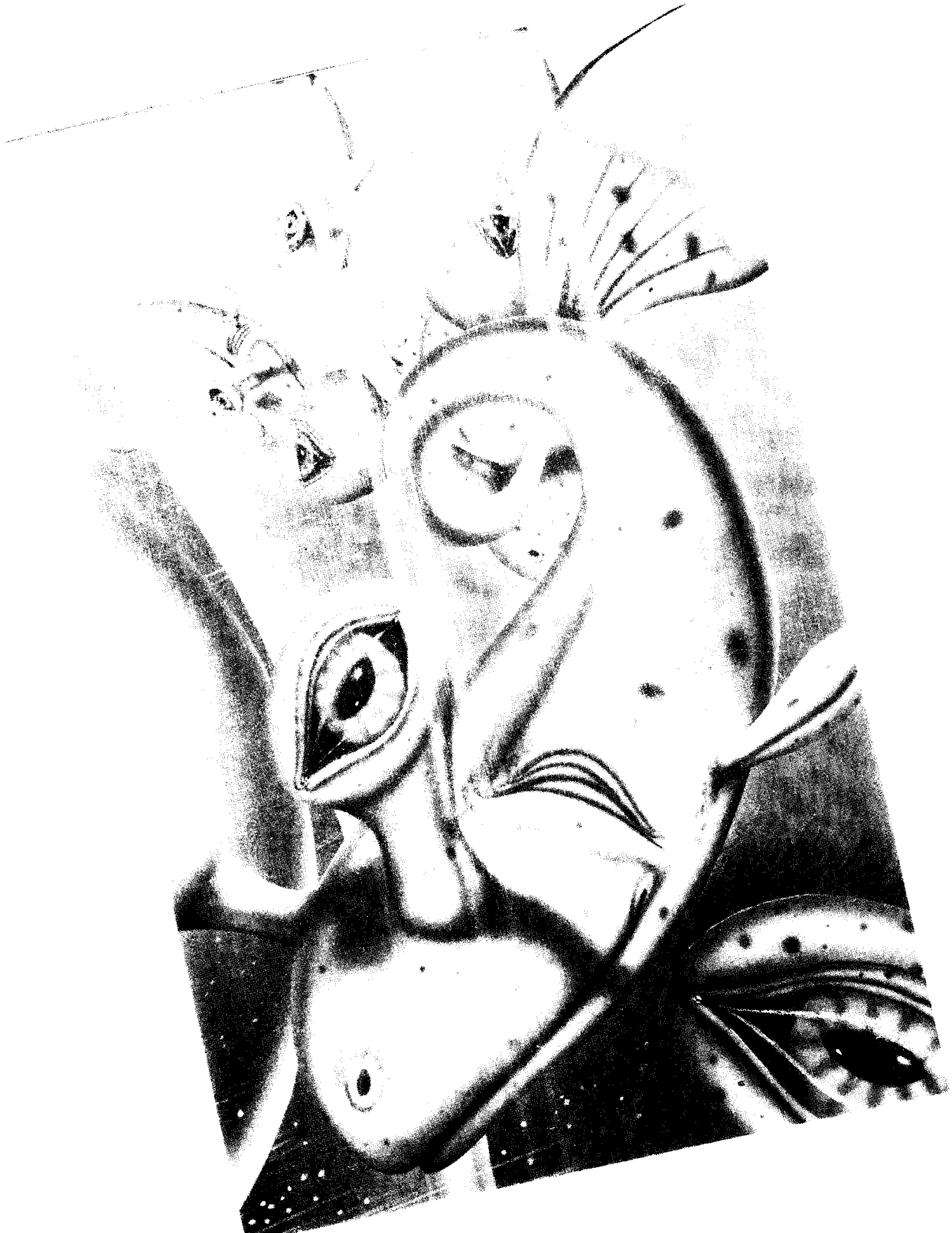

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One day you look at yourself in the shaving mirror and you realize you're never going to see forty again. If the shaving mirror is in a first-class cabin on a Special Envoy Starcruiser, the realization comes as no less of a shock.

I stared at the stubbled visage before me and yawned. Special Assistant to the Undersecretary for Planetary Indemnity. I was at the top of my career-curve with no stomach for the back-biting and in-fighting that would take me any higher. If I was lucky I'd stay at this level until mandatory retirement at 75. Unless some young lion pounced on me in the scramble for some higher job.

I scratched my chin and reached for the depilatory. It wasn't that I disliked my job. It was a detail job, and I'm good at that sort of thing. And I *did* get to see a lot of planetary real estate that I might never get to see in another line of work. But Stevens was such an ass.

As if I'd evoked him with the thought, the Undersecretary's voice came over the intercom from the cabin next door: "Mario, rise and shine, my boy. The captain informs me that we're in geosynchronous orbit. Planet-fall in half an hour."

"Yes, sir," I snapped, grimacing into the mirror.

The world rising to meet us was even bluer than the Earth. I rested my forehead against the shuttle window, searching for the landmasses. One small continent, perhaps the size of Australia, was all that I could make out. Several island chains arced near the equator.

Stevens was sitting beside me, rustling through several portfolios on Priam IX. Most of the information I'd collected for him—sorted, condensed and simplified from surveys, engineering studies, newstapes and xenobiological monographs. All put together so that the Undersecretary would not make a fool of himself. It was a living.

As we dropped lower I could make out the wakes of several huge fusion-powered hydrofoils—ore freighters of some sort, I imagined. Priam IX was a deep-sea miner's paradise. The ocean bottoms were covered with mineral-concentrate nodules containing almost every metallic element. Over a century ago the planet had been the focus of a galactic gold rush, as individual adventurers returned with nuggets of osmium the size of a man's fist. Next came venture capital in the form of small (often fly-by-night) corporations. Some of these overextended themselves and succumbed to bankruptcy, but enough of them grew into mega-credit refineries to interest the really big money giants of the galaxy. Most notably Pyrrhus Industries.

If you've been to any major industrialized world, you've heard of PI. If you were born on Terra, as I was, you grew up under the light of that intricate roseated jewel—the Pyrrhus Highworks at L5.

Pyrrhus's interest in Priam IX was why we were here.

Stevens nudged me with his elbow. "I'm afraid I don't quite know how you pronounce this. . . ." His index finger was pointing at one of the cultural summaries.

I squinted at the word: "Wyntaraag." "It's wine-tah-*ragg*, sir. Heavy accent on the last syllable. Roll your *r* if you can, sir." It was the natives' name for

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themselves. As usual, Stevens was doing his homework at the last minute. We'd had three weeks in hyperspace. Three weeks of subjective time in which he could have read this portfolio and the others. But H. Barclay Stevens, New Galactic Coalition Undersecretary for Planetary Indemnity, had spent that time dining at the captain's table, drinking hundred-year-old vintage port, making those incredibly expensive hyperspace calls to his stockbroker, et—*ad nauseam*—*et cetera*.

I made a mental note to include phonetic spelling of alien words in future reports and returned my gaze to the shuttle window. We had swung past the first continent—that would have been Finlandia, or as the early prospectors called it, Wolf, never mind what they called it. We were streaming eastward toward the larger equatorial landmass on the other side of the planet. Its strange bird-like shape began to emerge from the curve of the horizon. That would be Brudnyland, as the Polish discoverer had christened it. The native name was very hard to pronounce and not much used.

Unlike the natives seemed to be interesting lot. The Wyntaraag were not jewelers, though they'd evolved from a life in the sea much later in their history than we humans did. Perhaps no more than a million years ago. Their culture was stage four pre-industrialization, somewhat equivalent to the Iberian Late Neolithic. Almost all their livelihood was obtained from the oceans. They were prodigious sailors and fishermen, and most of their myths and religious beliefs revolved around the seas. The xenology studies I'd read had noted an unmistakable reluctance to discuss most of these with off-worlders, though in all other matters they were very open and friendly. It was clear that the watery part of their world—which was most of it—was sacred to them.

The odd thing was that not more of their ritual and mystique about the sea had leaked out in the hundred-plus years of galactic contact. Xenologists are a patient and persistent lot—I'd met a few of them over the years—often adopting the "total immersion" techniques of the old Earth anthropologists. As a matter of fact, one had used just such an approach on Priam IX among the people of a small sailing cult on one of the northern archipelagoes. I'd read the monograph with interest, but I must confess I no longer remembered the fellow's name.

At any rate, this chap had spent a planetary year—about one and a half Earth years, living, eating, and sleeping with this small band of Wyntaraag. He'd manned the oars on their fishing expeditions, delivered their babies, healed their sick. And yet, from what I remembered reading, the closest he'd ever gotten to their religious rites had been a few furtive peeks past the shoulders of the warrior-guards who firmly escorted him away.

"I see we've nearly arrived," Stevens was saying. And it was true: the shuttle window now revealed the stone and glass complex that Pyrrhus Industries had erected here. We were inching toward a formidable looking pad-port that looked like it was designed to handle heavy lift freighters.

Stevens aligned the edges of the stack of folders and tucked them in his at-

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tache. "Mario," he said, "I'm afraid I've only just had time to scan the bare essentials here. What say you fill me in, in your own words, that is."

The dinner party that Pyrrhus Industries threw that night rivalled the most opulent I had ever attended. A fact all the more conspicuously impressive because of the planet's "backwater" location and still relatively pristine state.

"Mr. Lassiter, have you met Mario Brisando, my aide?" Stevens was all atwitter and visually resplendent in the latest New York coiffured wig.

The gentleman extending his hand was blond and not quite fat. He wore his dinner jacket like a loose-fitting lab coat. "Mark Lassiter," he said, giving me an athletic handshake. "I'm chief assistant to Mr. Mooney."

Mooney was project manager for PI's activities on Priam IX. "You two will no doubt be working closely together in the next few days," Stevens offered, and then hurried off to button-hole someone across the room.

"Have you been living on Priam IX very long, Mr. Lassiter?" I took a light sip of a very strong cocktail someone had handed me.

"Mark, please. And may I . . ."

"Mario. Certainly. I was just curious about what life in this kind of isolation is like."

Lassiter produced a platinum-cased pocket watch with an inscribed lid. "Five-year award—that's local years—seven and a half all told. I arrived with the first surveying team that laid out this complex. The last three years I've been working exclusively out on the process platform."

"That's pretty far out to sea, isn't it?"

"Five hundred miles due north of here, right over one of the deepest suboceanic trenches on the planet. The breeding grounds are there."

"That would be the local marine life that Pyrrhus hopes to process, the . . . grotuck?"

Lassiter smiled. "I can see you've done your homework, Mario. Yes, that's a close approximation to the native word. It's a small . . . well, not fish exactly. Fish-like creature, I guess you'd say. About the size of a large herring—eyestalks and a fan-like tail, but otherwise a fish in the sense of a swimbladder and some things that function like gills. The little buggers concentrate and accumulate heavy metals—most notably rare earths—in a specialized organ they have."

A burst of laughter rang out from the small group that Stevens had accumulated around himself. "I understand," I said, "that PI is employing some new technology in this project. Obviously a substantial capital investment was involved."

"Those new hyperdrives being built these days require lutetium shielding. Each new engine uses almost three tons of it. Up until now the primary sources have been the Remus clays and the monazite sands on Earth, but extraction is energy intensive and, of course, only a small fraction of the rare earth components is lutetium oxide." Lassiter's eyes were beaming—he was on his favorite subject. "The grotuck here do some complicated chemistry in that little organ of theirs—ion exchange, actually. They not only collect rare earths from

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the sea water, concentrating them several million-fold, they actually reject and eliminate most of the lighter ones, leaving the heavy end of the group—primarily calcium."

I took another sip of my drink and exchanged the glass on a passing butler-unit. "So it seems the little creatures have done all the work for you."

"Not quite," Lassiter said. "The processing system really requires collection, but the product in a cost-effective system. The retrieval is in the form of an organic complex which is easily processed into ground fish meal."

I winced inwardly at the thought of the merciless gears of Pyrrhus Industries grinding up the helpless creatures. "That's where I understand you're employing some new technology . . ."

"Not new exactly," he began. But just then someone began tapping a glass somewhere.

"Ladies and gentlemen . . . dinner is served!" I noticed it was Tobias Mooney himself, standing at the head of the long prepared table. He was a very tall grey-haired gentleman with a bit of stage timbre to his voice. "Please find your place-cards and be seated!"

"Well," Lassiter said, "possibly we can pick this up sometime later."

The crowd flowed toward the table, where I found that I was seated between a stunning young woman and a Wyntaraag native. I introduced myself to both before sitting down.

"I'm Doris Mooney," the lady said. "And this is Punlaag il'Drok, First High Speaker of the Clan of Synbarstup."

I tore my gaze from her smiling blue eyes to regard the alien. A whiskered seal-like face sniffed at me with a black wet nose. The Wyntaraag were obviously descended from some sea mammal type of creature. I half expected him to smell fishy, but the odor that drifted to me was rather like cinnamon. "I am very pleased to meet you both," I said and sat down.

"You do eat-look my Terran-speech, no?" the alien said, fixing me with an unblinking brown-eyed stare.

"I understand you very well . . . Punlaag," I said, remembering from my reading that the locals in this region didn't use address titles.

"You come here . . . for consecration ceremony of the metal-place in the sea, is not?" Punlaag picked up a silver fork and scratched at his whiskers, absently.

The woman touched my left hand briefly. "I believe he means 'dedication'—the Company is planning a big party out on the process platform in a planetary week or so."

I noted the two opposable thumbs and odd finger-structure of the alien hand, still wrapped around the fork handle. "Ah . . . no, as a matter of fact. Actually, Punlaag, I'm here to be sure that none of your people's . . . rights are being violated by the building of the metal-place."

The alien's attention was caught by the plates of steaming dishes which were being brought in. "No problem," he said, absently. "There be plenty grotuck for all. Not much good for eat . . . too small."

Doris Mooney smiled. "Really, Mr. Brisando, the natives here perceive no threat from the processing plant. I believe the Coalition office overreacted by

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sending you and Mr. Stevens all the way out here."

"Very possibly," I said. "But the government gets very touchy when it comes to industrial operations this large on worlds with a stage-four culture. There have been very blatant abuses in the past."

"Not here, I assure you. My uncle has taken great pains during the construction phase to avoid any interference with the fishing routes of the locals. This complex here was built on uninhabited land. All shipments of materials to the platform were timed to avoid even near encounters with their boats."

I grinned at her enthusiasm, despite myself. "So Tobias Mooney is your uncle?"

"Yes, I'm here on a sabbatical from ICS to get in some field work for my thesis." She intercepted a passing platter and began serving the three of us from it.

"Thank you. Then you're a xenologist?" The Institute for Cultural Studies on Rigel VII was a prestigious school, indeed.

"I *will* be in another year, I hope," she said.

"That's very interesting," I said. "You must know the native culture here very well, then."

She shook her head slightly, rippling masses of blonde locks. "Not near as well as I would like. The Wyntaraag have been very cooperative, of course, but I haven't yet gotten a deep empathy with the culture."

Punlaag was already deeply engrossed in the soufflé of native vegetables on his plate. Between noisy mouthfuls he uttered: "Missmooney good with net-sewing. She help our women all day long . . . but teeth no good for biting rope." This seemed to amuse him, if the series of indrawn gasping noises could be interpreted as a horse-laugh.

"I've spent some time at Punlaag's fishing village on a small island a few miles off the mainland here. The people have been wonderful to me. . . ." She lifted her water goblet, letting the rest of her thought go unspoken.

The rest of the dinner conversation concerned itself with amenities. After the soufflé a delicious marinated roast of some indigenous herbivore comprised the main course. The wines were first-growth clarets brought from Earth.

Stevens was seated at the head of the table, next to Tobias Mooney. From the spirited goodfellowship that prevailed there, they seemed to have a lot in common.

When the plates were cleared, Mooney stood up and tapped his glass again. "May I have your attention, please, ladies and gentlemen. . . ." When the murmur of conversation faded, he said: "There's a little fish on this world that means a great deal to us here. . . . And so, in honor of our distinguished guests from Terra . . . and . . ." with a nod toward Punlaag: ". . . the good friends that we've made here on Priam IX . . . dessert will now be served. . . ."

At that moment the double doors to the kitchen parted and an enormous sculpted ice cream fish emerged, guided on a floating tray by two waiters. It was obviously meant to be a grotuck: a fan-like tail of lemon sherbet, scales made of overlapping orange slices, two large

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wedges of a local melon for the gill slits, a dark band of lime sherbet outlining each; pineapple chunks and cherries for the eyestalks. I had to admit it was a scrumptious-looking dessert.

"Please, friends . . . enjoy," Mooney said, sitting down, as the waiters busied themselves with serving the massive creation.

I was about to make some remark to Doris, when a strange whimpering noise from my immediate right caught my attention. I turned around to Punlaag, whose eyes were suddenly wide and wild. The native was staring at the ice cream fish like it was some monster about to devour him.

"Punlaag," I said, "are you feeling all right?"

He began to speak frantically in his native tongue, his eyes still fixed on the dessert sculpture. The waiters stopped serving, bewildered at the commotion.

Doris tried a few faltering words in native dialect, but Punlaag ignored her. He was shaking all over now and began to rise from his chair. A murmur of astonishment and turned heads ran through the guests at the table.

"Hoteraag rurvo unkeerah!"

"Punlaag," Doris was saying, reverting to Terran, "it's only some Earth food in the shape of the grotuck. . . ."

"Hoteraag trelfon mocht mokaltee!"

"What's he saying," I asked desperately. "Is he ill?"

Doris shook her head in frustration. "I don't understand all the words. That fish has upset him terribly. He's saying something about 'the lonely one' and the word for 'sacrilege'. That's all I can make out."

Tobias Mooney had gotten up and was on his way around the table with Stevens trailing uncertainly behind. Punlaag knocked over his chair and Doris and I grabbed him by the shoulders to keep him from falling. I could feel him trembling in my grasp. The cotton-like fabric that he wore was already damp with cold sweat.

Then suddenly he wrenched himself away from us and fled toward the door on the far side of the room, vaulting over an intervening footstool like a hurdler. In another moment he was gone into the night.

A shocked silence descended on the room, as we all stared at the still-open door.

I rose late in the morning the next day, having had difficulty getting to sleep after the dinner party. Despite a sinfully comfortable air mattress in the guest room, the strange ending to the dinner had replayed itself repeatedly in my mind.

I peered blearily through the heavy drapes at the window for my first real daylight view of the harbor complex. Priam, a type G on the main sequence, looked a bit smaller than Sol from Earth. Already it had climbed a few degrees above the watery horizon and its mirrored image danced in the waves at the limit of vision. A heavy freighter was cutting a wake several miles out, headed toward the process platform, no doubt.

The docks seemed to be a beehive of activity. I could see the slow graceful movements of large cranes around a couple of large ships in port. And air-vans of all sizes and descriptions swarmed overhead.

My room was on the twentieth floor

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of the visitor's complex—for all intents and purposes, a luxury hotel. It, like all the buildings, was stone and glass in the latest architectural style. Looking out from the room's window, one could easily forget that this was not a highly industrialized Coalition World.

The viewphone chimed. I took a quick glance at myself in the dresser mirror, shrugged, and pressed "receive."

I was a little surprised to see that it was Doris Mooney. She was in a simple dress that appeared to be the native cloth. "Good morning, Mr. Brisando," she said.

"I would have hoped we would be on first names by now." I smiled at her.

"Yes, of course. I'm calling to ask if you'd be interested in meeting with some of the elders of that island village I've been studying. Punlaag's reaction at the dinner last night has me completely puzzled. I'm going to try to find out what it was all about. I thought, perhaps, you'd be interested, as well."

I ran my hand through my disheveled hair. "I am, very much interested. The poor fellow was frightened out of his wits by something last night."

"Good," she said, all business. "I'm taking a launch out to the island at noon. We can stay all afternoon and return in the early evening. . . ."

Just then came a beep indicating an incoming call.

"I don't see why not at the moment," I said. "Doris, could you hold a moment; someone else is calling." She nodded and I punched "hold" and "receive-2."

It was Stevens. "Mario, my boy. Sleeping late, I see."

I couldn't keep from glancing down at my pajamas. "Ah, yes sir. I'm afraid I didn't sleep all that well last night."

Stevens took on a grave, fatherly tone. "You mustn't let that incident with the native last night trouble you. I noticed that you were seated next to him at the dinner. Mr. Mooney assured me that the natives go through a lot of hysteric mumbo-jumbo from time to time to draw some attention to themselves. It's a sort of a culture-shock reaction. He was undoubtedly trying to impress us, after getting some idea what you and I are here for."

And just what are we here for? To rubber-stamp Coalition approval on PI's investment? What I said was: "I really don't think so, sir. The local—Punlaag is his name—seemed genuinely frightened by something."

"Nonsense, Mario. I want you to forget the whole thing right now. What I'm calling about is that inspection trip I was scheduled to make out to that sea platform this afternoon." Stevens paused to regain his politician's twinkle. "The Terran Consulate's office on Fincaux is coming across planet to throw a little luncheon in my honor this afternoon. I can't very well disappoint them, so you'll have to take my place on the inspection tour. Please offer my apologies to Mr. Lassiter. A pterocoach will pick you up outside the hotel in one hour." He reached for the switch to cut the connection, then hesitated. "Oh, and Mario, take careful notes out there. I want lots of technical detail for the official report—the engineering details, of course, and the cost figures: you know, Pyrrhus Industries' investment in the future, their commitment to plan-

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etary development. You know what I mean.'' *Snap.* The screen was blank.

I released the ''hold'' button. Doris was still there. ''Sorry to make you wait like that.'' I said. ''I'm afraid I won't be able to make that trip out to the native village after all . . . .''

She was sympathetic when I explained the nature of my ''official business.'' having gained some knowledge of Stevens from the dinner party. We agreed to meet for dinner after we'd both returned from our separate afternoon trips. I told her I would be most anxious to learn what she would find out about Puntaag's strange behavior.

When I cut the connection and began to dress, I realized that I was also most anxious to have dinner with Doris Mooney.

The pterocoach was a single-pilot air-breather built by one of the PI divisions. I sat alone in the passenger compartment, which was laid out like a corporate conference room—the chairs were plush swivels with casters that automatically locked for takeoffs and landings. An immense table of real wood. Dictation equipment and a viewphone alongside each chair. The cabin walls were covered with the same plush carpeting as the floor—all in the corporate color: Pyrrhus Blue.

The pilot's voice came from the viewphone beside my chair. ''Is there anything I can get you, Mr. Brisando?''

''Nothing that I can think of, thank you.''

The screen came to life, showing the face of a blond bearded young man wearing sunglasses and a throat-mike. ''Name's Casey. Mike Casey. If there's anything you want, just let me know. There's a well-stocked food pantry back there and a wet bar, if you're interested.''

''How long will the trip be?'' I asked, trying to start a conversation.

''About a half an hour. We're doing mach 2 at 30,000 feet. Like to see an outside view?'' The screen showed blue water peeking through breaks in the clouds. I could just make out the pattern of tiny white-water breakers.

''It looks a little rough down there.''

''Thirty-foot swells. That's typical. Some of the smaller hydrofoils get knocked about from time to time.''

''Do you make this trip very often?''

''Three times a day, sometimes more. And there are five others on the same schedule. That's not counting the big rocket-buses and short-jump freighter rockets. And, of course, there's a lot of traffic by sea.''

I clicked off the chair's inertia field and crossed my legs. ''Sounds like they should have built a bridge,'' I mused.

''Don't think it hasn't been considered. From what I've heard, the Company did a cost study on that.''

''Have you worked for PI very long?'' I asked.

The pilot's face reappeared. ''All my life,'' he said. ''I was born on Priam IX. My father was an underwater construction worker for PI until he retired a couple of years ago.''

''I guess you live in the worker's quarter back at the complex?''

''Naw,'' the pilot said. ''My dad was always an independent sort, and I guess I am too. We've always lived off the complex, in the outback. Actually, it's not so uncommon any more. There's

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lots of homesteads as far as fifty miles from the PI complex."

"Any problems from the Wyntaraag?"

"The seal-faces? No, they keep pretty much to themselves. . . . Oh, sometimes when I was a kid we'd see them running through the countryside carrying torches. A hundred or so of them, sometimes. My dad always kept them away from our property with a few shots in the air from a handlaser. He was afraid they might set something on fire. . . ."

I studied the face on the viewphone screen. Casey was probably twenty-five or so, had grown the beard to look older. "Any idea what that was all about? The torches, I mean."

"No idea," he said. "Only thing I remember was the time me and some other kids from the company school followed one of them on a dare. A couple of miles we ran after one of those characters. We were just kids. After a while we were pretty scared—didn't know if we'd be able to find our way back. We hid behind some owaraab bushes and watched. Hundreds of these native runners, each carrying torches, came together in a big clearing."

The coach hit a small airpocket and Casey touched a control. "Sorry," he said.

"What happened in the clearing?" I asked, *really anxious to know.*

"Well, they all got together in a big three-deep circle around a big pile of interwoven sticks and dry brush. The thing was in the shape of a fish—enormous thing, maybe fifteen feet high. They were yelling and chanting and carrying on for a long time. We were just about ready to try to find our way home when all of a sudden they all touched their torches to this thing. I don't know what kind of wood that was, but that pile almost *exploded* into flame. All the seal-faces cleared out then, leaving that burning fish with flames shooting maybe a hundred feet into the sky. We got out ourselves then, scared senseless. Found our way back all right. But I've never forgotten that night."

Mark Lassiter was standing at the edge of the landing pad as I stepped out of the coach. I had not been prepared for the size of the process platform and was still reeling a little at the immensity of it as he was shaking my hand. Imagine a rectangle of steel four kilometers by two set in the middle of a featureless ocean. Imagine a complex of pipes, each one thirty feet in diameter, snaking between motors and machines the size of a city block. Only in space had I seen the works of man conceived on such a scale. But there, I thought, they were somehow dwarfed by the void.

"Good trip, I hope," Mark was saying.

"Oh . . . yes. No problems."

"Sorry Mr. Stevens couldn't make it. Some urgent business came up, I understand."

I wondered what kind of story Stevens had concocted. "Yes," I said. "*He offers his sincere apologies. I'll be* sure to fill him in on all the details."

He guided me toward a moving walkway. "Fine. Ordinarily we'd reschedule the 'Cook's tour' to accommodate you both, but our startup deadline has been moved ahead a full week. We'll be making test runs starting tomorrow.

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Now, first we'll get into some coveralls and then you can see for yourself what we're doing out here."

We changed in one of the administration building locker rooms. The coveralls were Pyrrhus Blue with a large "PI" on the lapel. After donning safety shoes, safety glasses, and hardhats, we were ready to begin the tour.

"I guess we'd better begin at the beginning," Mark said. "That means the ocean itself. I'll take you to the monitor room."

We entered a building marked "Process Control" and I was immediately confronted with a bewildering array of switches and dials that looked for all the world like the command deck of a star-cruiser. "This is the nerve center of our operation," Mark told me. "All our main computers are here. And from here we can monitor and control all the primary systems." He indicated a wall of viewscreens. "Over there we can see what is happening in any stage of the process."

He motioned to one of the technicians. "Harry, put up number seven for me, would you?" A huge theater-sized holoscreen came to life with a depth-image of an underwater scene. Large open pipes shimmered in the murky light from unseen spotlights. "This is where it begins," Mark said. "These are the intakes—almost a kilometer below sea in the oceanic trench. The grotuck schools will be drawn in here along with several hundred tons of seawater."

I noted with amusement that someone had scrawled, "Gone Fishin'" on one of the pipes. "Won't the grotuck eventually learn to avoid this area?" I asked.

"Hopefully not, with the bait we're offering them. That's sort of the key to this whole operation. Notice the small nozzle at the end of each tube. That's where we will dispense a powerful pheromone to attract them. Only a small quantity is needed. Once the pumps are started, they'll be drawn into the processer."

"I gather the pheromone you're using has been well tested."

"Oh, yes. The original work was done by one of our scientists. I'll be showing you his laboratory later. It's quite effective. Actually we derive it from the grotuck themselves. It's secreted only during the normal mating season by both males and females, but its presence in the water induces the mating urge at any time of the year. The grotuck are drawn irresistibly to the stuff. Only a few molecules are enough to elicit the reaction, but they're drawn deeper and deeper into a concentration gradient. Of course, the highest concentration will be right there at our intakes."

I couldn't help pondering the hapless grotuck lured to an irresistible fate. "Sounds like it will work," I said.

"We're confident it will. Next let me show you the ultrasonics."

It was an automated chamber of horrors where the living flesh of the grotuck would be disrupted by high energy ultrasonic waves. "Those are the lead titanide transducer housings," Mark was saying as we walked through the massive piping maze. "The wet slurry emerges here. Then it's dried on a moving bed microwave system—that's the large steel unit over there." We walked for almost an hour. "Those are the cal-

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cining furnaces where all the organics are burned off. Over there the residual calcium from the skeleton is scrubbed with an acid leach and ion exchange—the big towers you see down at the end—there we strip off the lutetium chloride." More walking—now amidst smoke and fume. "Molten salt electrolysis—here we get the metal as raw sponge. It's kept under argon from this point on. Over there is an automated rolling mill in an argon chamber; men work in space suits in there."

Finally we entered the shipping and storage area. "The coiled strip is packed in argon-pressurized containers," he said. "From here it goes back by hydrofoil to the mainland, where it will be shipped all over the galaxy."

"How much are you expecting to produce?"

"At peak capacity, about five and a half tons per day. Enough to shield all the tachyon decelerators in two typical hyperdrive starship engines. That doesn't sound like a great deal, but the current market price for drive-grade lutetium shielding is about five thousand credits a kilo."

I whistled at the prospect. "Sounds like you're going to have a significant impact on the market."

Mark lifted his hardhat to brush back his hair. "Initially we'll be selling primarily to other PI divisions—the shipyards at Sirius XII and Pluto, where they build the big starcruisers. Eventually we'll sell to other builders. Naturally, we'd like a good return on our investment here, so we expect to hold the price for a while."

"How many people will be working here?" I asked.

"When we're running at full capacity, about five hundred. It's really heavily automated, as you've seen." He led me toward a small elevator. "All that's left for you to see is Dr. Sissman's laboratory, where the original work was done producing the pheromone."

The door to the lab was locked, and Mark let us in with a magnetic passkey. Small vats of liquid lined a bench down the center of the room, each stirred with a vaned propeller mixer. The walls and other benches were scattered with assorted equipment that might have belonged to either a chemical or a biological lab.

"Dr. Sissman is on a sample-gathering expedition right now—somewhere in one of the southern hemisphere seas. He did the original work on the grotuck pheromone at the University of Neu Mars. Pyrrhus hired him when the prospect of this project came up. Right here in this lab he developed the procedures for batch production. We'll be using about twenty liters per day. . . . As I said before, it doesn't really take very much to do the trick for us."

I noticed that a large wall chart contained anatomical drawings of the grotuck—three pictures, each in vivid color, each slightly different. Somewhere among the stirring vats a bell went off that made me start. Mark grinned. "Everything's been automated here. That bell means that one of those vats is ready for decanting. A technician will be along in a few minutes to take care of it." Mark removed his hard hat and tucked it under his arm. "Unfortunately, the pheromone doesn't lend itself to continuous production. Doc Sissman is working on it, but the pros-

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pects don't look promising. Right now we have several hundred gallons in reserve—all of it produced in small batches in these tanks."

I glanced again at the wall chart and the strange internal organs of the creature that it depicted. "If you make the pheromone from the grotuck themselves—" I began.

"We obtain large batches of the fish from the Wyntarag fishing boats. We pay them handsomely, I might add. The original sample of pheromone was made from a batch in the mating season. We used that to induce the mating frenzy in later batches and obtained more pheromone. And so on. . . . Once we begin production we plan to divert small amounts of live grotuck from our process for the production of all our pheromone."

"I suppose that you don't expect to run out of grotuck," I said. "I mean, you must have made some studies of the population of these animals." I had images of yet another animal exploited to extinction.

"Hardly," Mark said. "The doc here has studied the grotuck population in this ocean in great detail. A lot of work with submersibles and fish counts in the natives' trawling nets. It turns out that these little critters are quite prolific: typical schools number in the millions. We'll be collecting hardly more than the normal attrition rate—large predator fish don't seem to bother with them much. Most of them die naturally of starvation in the competition for plant foods."

Their arguments seem sound, I thought. *Why do I feel so bad about this?* I said: "It sounds as though you'll merely be thinning the herd, as it were."

"Exactly. We may actually be insuring the survival of this species."

"And making a lot of money for Pyrrhus Industries, besides."

He grinned broadly. "That too."

Priam was a red coal sinking between the gantries of the pad-port by the time I returned to the mainland. When I entered my room in the visitors' complex, a message was blinking on the viewphone screen:

> MARIO:
>
> SOMETHING HAS COME UP WITH THE LOCALS. PI MANAGEMENT HAS ARRANGED A MEETING IN THE GENERAL OFFICES. THEY WANT ME AS AN IMPARTIAL OBSERVER. PLEASE HANDLE MY CALLS.
>
> —H.B.S.

That's interesting, I thought, wondering if it could be connected with Punlaag's outburst at the dinner party. It sounded like it was strictly closed-door or else Stevens would want me there. I was glad, however, since I was still looking forward to dinner with Doris Mooney.

I erased the screen and then paged through the messages that Stevens's phone had channeled into mine. Current stock quotations on the Coffee System Exchange, a flirtatious greeting from an old flame on Luna, an impending real estate deal on Aborax, the regional governor on the Dansker Free World Republic wanted to know when they were going to meet for poker. Nothing from the New Coalition Headquarters. I sighed

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and jotted down the essentials from each message.

I'm forty-two years old, I kept thinking, *and I'm still an office boy for a senile social butterfly*. It wasn't at all what I'd imagined I'd be doing when I'd entered government service—what was it?—twenty years ago.

When I reached the end of Stevens's messages, the machine cycled in one of my own: it was Doris, looking tired and frazzled, asking me to call. I punched in the number she'd given me.

"I didn't get very far with the Wyntaraag today," she told me after we exchanged greetings. "Something is definitely in the air. The males had a big meeting in the council-hut, but they kept me busy with the women. I couldn't get them to talk about it."

I told her about the message that Stevens had left on my phone screen. "I haven't been able to reach Uncle Tobias since I've gotten back from the village, but his secretary told me that a lot of Wyntaraag were in and out of his office all day. Maybe we'll be able to make some sense of this over dinner."

The restaurant was a few blocks from the visitors' complex. It was a small, quiet place with subdued incandescent lighting and an antique decor. Doris was dressed in a loose over-the-shoulder sarong and looked just lovely. "It's very frustrating," she said, sipping at a kir, "being both an out-worlder *and* female."

"I don't object at all," I said, hiding a smile behind my glass.

She didn't pause, but her eyes sparkled. "The Wyntaraag have a typical stage-four cultural response in a male-dominated society. I hadn't fully realized before how . . . I was being patronized. . . ."

I saw that the experience had really hurt her at some level. Almost as if she felt betrayed by these people, for whom she obviously felt some fondness.

"In your past work," I said, "weren't you excluded from religious ceremonies?" I told her about the xenological monograph I'd read.

"Oh, yes. Certainly. But I always felt it was the special secretive response they have about their religion. In all other aspects of their everyday lives the Wyntaraag are an extremely open and friendly people." She paused a moment, lost in thought. "Are you saying that . . . that Punlaag's reaction last night had something to do with their religion?"

I shrugged. "It's possible, isn't it?"

"The council-hut is not on sacred ground, like their temple. I naturally assumed that the meeting was about tribal policy. Punlaag is their First High Speaker—that's roughly equivalent to the head of city council or the mayor—strictly a secular office. The priest-brotherhood are quite separate."

"But they participate in the council-hut meetings?"

She set her glass down and some of the kir splashed out. "Why yes, they always do." She looked directly at me with those achingly blue eyes. "You see, even though the females and young males were always excluded from the council meetings, the Wyntaraag had always permitted me to attend. In the past the meetings concerned things like fishing schedules, squabbles with neighboring clans, civil trials of one sort or another. I naturally assumed that re-

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ligious matters were excluded, but I might have been wrong."

"And if a religious matter came up, you, as an outworlder, could not be permitted to attend."

"That's right. It's the one point the Wyntaraag are universally adamant about."

The waiter came and took our orders. We were silent for a time after he left. Finally I asked, "Do you have any insights at all about the Wyntaraag religion? I assume there is some deity [illegible] the sea."

He hesitated a moment, as if privy to some secret information and wondering if I was to be trusted. "Actually, I have a little. It's going to be [illegible] at IC'S. Working with the males has its advantages. While the males are very close-mouthed about religious matters, the females are garrulous because they are excluded from the temple ceremonies [illegible] talk a little. I'm convinced that the majority of the females, especially the older ones, know all the secrets the males tell them certain things slip out, and a certain amount just gets absorbed by osmosis during their lives.

"You're right, there is a sea deity—only one. It may take a variety of forms depending on whether it is pleased or angered—always some form of marine life and usually a fish-like creature. I'm not sure of all the names and nicknames and their corresponding physical forms." She reached down and retrieved a small handbag that she'd propped against a chair leg. "I managed to convince a young girl to give me this. She found it lying on the ground. I believe it's a religious icon that one of the males dropped."

She produced a small ring of copper with several carved stones strung on it. I took it from her and examined it in the dim restaurant light. The tiny sculptures were crudely fashioned and painted with streaks and dots of various colors. There was a whale-like creature with a dorsal fin, a coiled eel-like thing with a broken tail, something that might have been a crab, and . . .

I held the last image closer to my eyes, letting the rest of the ring dangle freely. It was a grotuck, or appeared to be. Dabs of paint had been applied to it, like the others. Yellow on the tail, orange on the sides, and a small green semicircle outlining a tiny gill on each side. My thoughts went back to the wall chart in Sissman's laboratory.

"Doris," I said, "look at this."

"Yes, I think it's a grotuck. But that isn't surprising. They're the most common fish in these waters. The Wyntaraag catch millions of them. It's understandable that the grotuck would be one of their images of God."

I held the icon closer to her. "Do the grotuck have those green markings on the gill slits?"

"I don't think so," she said. "I never really looked at one that closely. . . . No, I don't think they do. At least, not the ones that I've seen in the Wyntaraag nets."

"But that big ice cream fish at the dinner that had Punlaag so upset—it had green gills, didn't it?"

She pondered a moment. "Yes. Melon wedges or something. Probably just an embellishment of the chef's."

I tossed the copper ring on the table

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in front of her. "But I believe it was the detail that caused Punlaag to react. He may have felt that we were about to devour his god. Or perhaps he took it as some kind of omen about the Pyrrhus project."

She took up the ring, turning the grotuck stone carving over in her fingers. "Mmm, yes. That kind of detail difference could be significant to the Wyntaraag. We *are* dealing with an alien mind. And also one at a pre-industrial level."

The waiter reappeared with our dinners: we'd both ordered seafood and suddenly I'd lost my appetite. "After I called you, did you try again to contact your uncle?"

"Yes, and he was still in a meeting. I noticed that some Wyntaraag were still milling about in his outer office behind the secretary's desk."

"Do you suppose," I said, toying with the food, "that the word has spread among the local clans that Pyrrhus Industries is about to commit some kind of sacrilege?"

"Come to think of it, 'sacrilege' was one of the native words that Punlaag used during his tirade last night. And word *could* have spread to the mainland clans. Their boats travel all over the local waters, including the entire length of some of the nearby rivers. The mainland clans use runners as message-bearers, as well."

The vaguely unpleasant feeling that I had had about the PI process platform had just taken a quantum jump. And yet, I told myself, I was reacting to the native superstition. I felt I had to find out more. For the first time since I had arrived on this world, I thought I might serve some real purpose here.

One image kept returning to me as we ate for a time in silence—the wall-chart in the laboratory where the pheromone was processed. I couldn't remember many of the details with all the multi-colored internal organs that had been depicted. But why had there been *three* grotuck pictured on it?

"Doris," I said, at last, "is there any chance that a library terminal—one with a good science file—might be available at this hour?"

"Well, I know the one in the general offices will be up and running as long as Uncle Tobias is in the building. There are probably several in the engineering section too, but I don't know where they are."

"When we're finished here, I'd like to look some things up."

She pushed her half-finished plate away. "I'm ready if you are," she said.

As I was paying the bill, I noticed that she looked distant. When I asked, she said: "I was just thinking about that other word that I could make out of Punlaag's ranting last night."

I remembered what it was too: *The lonely one.*

The massive marble-walled lobby of the general offices building was dark and it felt like entering a museum after closing time. The lone watchman had peered at us suspiciously until he recognized Doris.

"Bunch of them native-folk just left, ma'am. Your uncle and some others are still up there, though."

"Thanks, Sam," she said. "We won't bother them—we're going to use

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the search terminal on the nineteenth floor."

Once past the lobby, the building was ablaze with light. We took a fast elevator.

The nineteenth floor was a technical management section immediately below Douglas Mooney's office on the twentieth. It was empty except for a two-man cleaning crew, who ignored us.

"Right here," Doris said, pulling up two chairs before a viewphone-sized screen. She tapped in an identification code and the screen lit up with the PI logo.

I sat down and typed a string of keywords: PRIAM IX, GROTUCK, SEX, GENDER.

Doris looked at me but didn't say anything. The screen came back immediately with: 409 REF., TERRAN ENG.

"Expected yes." And received: 317 REF. PRESS ENTER TO BROWSE.

Hitting the ENTER key produced a succession:

SISSMAN, M.R., "TRISEXUAL BEHAVIOR IN [illegible] VERTEBRATE," ANAT. SCI., 7 (4), 1305-26.

SISSMAN, M.R., "THE GROTUCK AS A MODEL FOR CONVERGENT EVOLUTION, OR SEXUAL POLYMORPHISM," J. EXTERR. ZOOL., 34 (7), 432-46.

JAKES, C.V., AND SISSMAN, M.R., "THE ROLE OF THE TRELPH IN GROTUCK MATING," NATURE, 711 (22), 881-3.

GRUSSAGG, E.E., "THE FAUNA OF PRIAM IX," U. OF DEVANDERMEER PRESS, 2551, 364 pgs.

SISSMAN, M.R., "IS THE TRELPH OF PRIAM AN EXAMPLE OF ANOMALOUS GENETIC [illegible]," XENO. GEN., 9 (1), 304-36.

SISSMAN, M.R., AND JAKES, C.V., "THE THREE GENDERS OF THE GROTUCK," SCIENCE, 494 (34), 1741-3.

"Looks like heady stuff," Doris said.

I punched for the *Science* article, erasing the rest of the list. What came up on the screen was tough going for the layman, but after half-reading, half-skimming the entire article and studying the illustrations, I began to understand the basic facts.

The grotuck do, indeed, have three genders—male, female, and what has been termed *trelph*. It results from a rare accident of evolution, a shuntoff of the mainstream which is probably traceable all the way back to the time of the first emergence of bisexuality on this planet. Some ancestral chordate relative of the grotuck developed this unusual form of reproduction while the rest of the life-forms pursued the usual form. Conditions proved favorable for the survival of this line and they evolved into the present-day grotuck, while the bisexual life-forms proliferated and diverged, eventually producing all the other life, including the Wyntaraag, on Priam IX.

The grotuck female produces eggs, like other female species. During the breeding season the eggs emerge and adhere to her abdomen in a gelatinous mass. The female generates the pheromone which attracts the male. The male inseminates the eggs in the usual manner, but the eggs remain infertile. While single-celled zygotes are produced, they do not have the power to subdivide. The act of insemination also causes the male to produce the pheromone. While chemically indistinguishable from the female's pheromone, the male pheromone,

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possibly due to its higher concentration in the water, now attracts the trelph.

The trelph live apart from the large schools of male and female grotuck. While laboratory counts have shown that they account for a third of the live births, they confine themselves to solitary lives in the deepest parts of the oceans. When the concentrated male pheromone reaches them, they are drawn to their only form of social activity. A special gland in the trelph secretes a catalytic enzyme which it applies to the mass of eggs attached to the female. The enzyme starts the zygote cell's machinery, mitosis begins, and the long process of division and growth is on its way. After their sole contribution to their species, the trelph return to the depths from which they come, grazing on bottom-dwelling algal forms.

"And it's the trelph that have the green markings on their gills," Doris said, studying one of the article's illustrations.

"Yes. The green markings are the only *external* difference between the trelph and the other two types of grotuck. Apparently there are a lot of internal differences, though. And not just the specialized reproductive apparatus."

Doris squinted at the anatomical drawings on the screen. "I didn't catch that part. What other differences?"

"Well, for one thing, their body tissue—both musculature and internal organs—is adapted for the tremendous pressure change they experience when they come to the surface."

"That's right," Doris said. "Come to think of it, I remember reading somewhere that bottom-dwelling fish literally explode sometimes when they're brought to the surface."

"Evidently the trelph are able to come up safely because of a rapid and reversible reaction that . . . cross-links certain polymeric compounds in some of their tissue layers."

Doris smiled. "How's that again?"

"I'm not a chemist," I said, "but I was involved with an indemnity case once on Bela's World. It concerned a producer of thermal plastics. Polymers are long chain molecules. When you form cross-links between the chains, the materials generally get stiffer and tougher and less permeable. The old process of vulcanizing rubber is an example of it.

"Most material in living things is polymeric. The trelph can sense an external pressure change and somehow instantly alter their body tissues —toughening their hide, as it were, by cross-linking certain polymers. The mechanism only works when they're rising or going down, allowing time for pressures to equalize in their body cavity. Once that occurs the polymers return to their normal state."

"Ingenious little buggers," Doris said. "But it's their little green gills that got Punlaag so upset."

"Mm, yes," I said, studying the screen, absently.

Doris pushed her chair back a bit. "I guess the fact that they spend most of their time living near the sea floor alone explains why I've never seen them in the Wyntaraag fishing nets."

I rested on my elbow and looked over at her. "The Wyntaraag might catch a few during the breeding season, but it would be a rare event. That might ex-

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plain why they chose the trelph as an avatar of their sea deity."

"Possibly. But we don't know if the trelph is an angry god or a friendly god."

I managed a small grin. "Either way, your uncle's company seems to have committed sacrilege against him."

"I guess we'd better tell him what we've learned."

I arched my back and stretched, a little stiff from bending over the screen. "I suspect that there's little we can tell him that he doesn't already know. Except, perhaps, to hire a less creative chef the next time he holds a dinner party. I was going to suggest a little further investigating—are you up for a night-time cruise?"

Doris was caught by surprise. "You mean go out to the island? Now?"

"It's just a hunch, based on a story the pterocoach pilot told me this morning. There's still a piece of this puzzle not dovetailing right."

"Like why was Punlaag scared instead of outraged?"

I looked at her eager expression and knew that we'd be going. "And also," I said, "I'm beginning to wonder why he's a little scared too."

We took an autocab down to the docks, and Doris led the way to a small launch moored between two medium-size hydrofoils. Priam IX has two moons, Hector and Paris, sons of their father, the sun. Hector hung gibbous and nearly full just above the horizon, while Paris was a thin sickle overhead. There was almost enough light to cast shadows.

Doris hopped onboard, while I unsnapped the mooring line. Climbing up, I noticed the PI logo painted on the side alongside the boat's name: *The Lucky Lady*. From the deck it appeared to be a sizable craft—twenty-five feet, at least—with one stateroom and a control cabin atop. By the time I mounted the short ladder, Doris had already started the motor and we were backing slowly into the bay.

"You look like you know what you're doing," I said.

"I ought to," she answered without taking her eyes from the controls. "My dad was a merchant captain back on Earth. I practically grew up on the big cargo hydrofoils."

As the launch swung around and headed out to sea, I studied her dark silhouette against the shimmering water. A salty breeze gently tossed her hair. I couldn't help wondering what she thought of the middle-aged office boy sitting beside her.

I reached in a pocket and removed the small recording chip I had made before leaving the terminal in the general offices. "You said there was a reader onboard?"

"Right here." She opened a small compartment in front of me.

I snapped in the chip and the display lit up. It was a book on the history of industrial contact with Priam IX that I'd selected on impulse from the computer file—one I hadn't read in preparing the portfolios for Stevens.

"Mario." It was the first time she'd called me Mario. "What did you do before . . . joining government service?"

I looked out at the moonlight shimmering on the sea. "Nothing very ex-

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citing, I'm afraid. I grew up in Kansas, studied foreign affairs at Harvard. I wanted to be a diplomat, but I wasn't diplomatic enough to land a job in the State Department. Outworld Affairs was a growing agency—they hired me as a staff assistant."

"No hobbies, outside interests?"

"I read a lot. Too much, I guess. Chess, stamp collecting, all the usual introverted things." I smiled at her dark outline. "I told you—nothing very exciting."

"But now, in the Planetary Indemnity Office—you must get to see a lot of different worlds."

"Quite a few, that's true. Often from a rather confined perspective, though. Meetings, hotel rooms, that sort of thing."

"You must enjoy it, though."

"I guess you can say that I know my job. There's a certain pleasure just in that. Sometimes, lately, I've been wondering if I shouldn't have pursued a different path . . . but you reach an age when it's too late."

In the darkness I couldn't tell if she was looking directly at me. "It's never too late, Mario."

"I'm forty-two," I said. "You don't start chasing rainbows at forty-two."

There's a certain kind of woman who finds herself drawn to shy, sad men. I didn't know if Doris Mooney was that kind of woman, but she said, "It's never too late," and, in the darkness of the cabin, placed her hand over mine.

The island was a dark tangle of foliage about a kilometer across. We approached from the mainland side and entered a small channel that grew rapidly narrow and sinuous.

Doris cut the engine and we drifted slowly, the titanium-composite hull thumping heavily against invisible rocks. All was blackness now except for the running lights at our prow. I could feel the steep banks of the channel closing in around us.

"Have you ever visited the island at night?" I asked.

"No, I'm sure they're not expecting a boat."

Dimly, through the intervening trees, we saw a wavering light pass by above us. A few seconds later, another light. Then another.

"What could that be?" Doris wondered, not quite frightened.

"Torches. I think we arrived just in time."

A practised burst from the engine, and Doris expertly nudged the launch into a small shoal. The keel ground sickeningly for a moment, and we had come to rest.

As we were climbing down the ladder from the cabin, I realized that neither of us was dressed for this adventure. "I've got some clothes for both of us in the sleeping quarters," Doris said. Both of us had taken to whispering.

I fumbled my way behind her into the pitchdark stateroom. "Here," she said, and I found my arms full of cloth, "those should fit."

I bumped into the bed and sat down awkwardly. I could hear Doris changing on the other side of the room. "Do you want a light?" she said matter-of-factly.

I could feel the blood rush to my face. "Uh, I'll manage."

The moonlight on the deck was like

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midday after the blackness of the stateroom. We were in shirts and trousers. I noted that Doris had taken the time to tie a scarf about her neck and had used another to tie up her hair.

We slipped over the side and scurried up a slippery bank. Doris led me through the scrub undergrowth, both of us keeping low. "I'm going to lose a lot of their confidence in me if they catch us sneaking around from like this," she whispered.

"I don't think it doesn't come to that."

But then the foliage ahead rustled and a Wyntaraag native carrying a smoking torch ran by us, oblivious to our presence. We both froze instantly. Further into the depths of the trees several more moving torches could be seen.

I bent close to her ear, a touch of perfume reaching my nostrils. "This has got to be the ceremony the pilot described."

"Follow me," she whispered.

We continued our crouching walk through the brush and trees, the distant torches becoming ever more numerous, until we reached a vantage point under cover just outside the village clearing.

The Wyntaraag huts were circular, made of wood and clay with cone-shaped roofs of thatch and straw. All were of similar design, though two of them, which I took to be the temple and the council hut, were much larger. The layout of the village was a large arc, almost a semi-circle, with a huge open space before it. There, as I had somehow suspected, was the rough-hewn image of the fish that the pilot, Casey, had described from his boyhood memories. Branches and twigs and dried vines had been interwoven to create a basket-weave sculpture. The thing was taller than a man and much taller than the diminutive Wyntaraag, but not the fifteen feet of Casey's childhood perspective. It *was* an impressive thing, considering the brief amount of time in which it must have been built.

"My God!" I heard Doris exclaim. And then in an exaggeratedly hushed tone: "That wasn't there this afternoon."

The village clearing was bright now and growing brighter as Wyntaraag torch-bearers running in from their ceremonial jaunt through the woods began to form a great circle around the wooden fish. A low moaning chant began to reach us and the alien bodies in the still-forming circle started to sway rhythmically. A cloud of black smoke from the burning pitch of their torches drifted slowly over the roofs of their huts.

"What do you suppose this means?" Doris whispered. "An appeasement to the trelph-god?"

I shrugged in the darkness where we crouched. "Or calling down his wrath on the Outworlders who have offended him."

I could feel my heart pounding against my ribs and the cold trickle of sweat down my sides. The circle was complete now—three deep, just as Casey had described. The village was as bright as midday with yellow flickering light. The monotonous chant was punctuated with yells and hoots—it was hard to tell if they were native words being shouted or just wordless cries.

My thighs were starting to ache and a sudden shift in the wind was bringing the torch smoke toward us, making my

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eyes water. Doris was starting to get uncomfortable too. "How long do you want to watch this?" she whispered.

I shifted my weight and a branch snapped loudly underfoot. Instantly there was sudden movement among the Wyntaraag. The circle broke, the torches moving toward us.

"Run!" Doris said, but it was already too late. The oddly shaped hands of the Wyntaraag were on us in a bruising grip, the light of their torches glaring into our eyes.

We were hauled rudely into the village clearing, where the circle of torch-bearers had broken apart. We were confronted with a random pattern of bobbing flames that formed a wall between us and the wooden image of the trelph.

I noticed heads peering from the closed huts—females and children forbidden to witness the sacred ceremony but aware that something was wrong.

Our hands were expertly tied behind our backs with a few deft turns of rope and a quick knot. The constant babble around us sounded confused and uncertain, but those kind of interpretations usually turn out to be anthrocentric. "What are they saying?" I managed to get out, when Doris had been brought near.

She was white with fear. "They think the company sent us. Again something about sacrilege. Some words I never heard before . . . probably . . . probably part of their ritual."

"Take it easy," I said, trying to calm us both. "Nothing is going to happen to us. These people know you."

A figure emerged from the ragged line of torch-bearers. He carried no torch. I couldn't be sure, but Doris confirmed my suspicion: "Punlaag!"

The alien, so out-of-place and almost comical at the Pyrrhus dinner-party, walked slowly toward us with an ominously serious bearing. He stood before us finally and studied our faces in silence. The crowd noise muted to a low murmur and then to silence. Only the crackle and hiss of the torches could be heard.

"Punlaag," Doris said. "On my word we come as friends."

The natives who had tied our hands now jerked us roughly together so that we faced Punlaag as a pair.

The First High Speaker continued his silence.

"*Murata, Punlaag,*" Doris began falteringly. "*Murata bokung teerah . . .*"

"I think," Punlaag said, "Missmooney shudda stay home. Keep her talk and her people."

"Punlaag, I . . ."

"I think Missmooney wanna big hurt cause. Come for smile and learn, but in her *garungaag*, in her spirit, she wanna help with bring this great pain on us."

"What pain, Punlaag?" I tried to sound sincere. "I asked Miss Mooney to bring us here, because we were . . . worried and saddened by your . . . actions at the dinner last night! We mean you and your people no harm. None of the Earthmen mean you any harm!"

Punlaag looked at me. If those unblinking brown eyes could have held an expression, it might have been contempt. "I know you, barely, Mistah

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B'sando. But you know and I know you not belong to be here now."

Doris's voice was pleading. "Punlaag, please. Try to understand. We came to learn the problem. So that we can help you!"

Punlaag's whiskers twitched and he began to pace slowly in front of us, those odd fingers laced behind his back. "Yes," he said, "you may know the why reason. Right is yours, you both, now. For you now, it is sad, must die."

My heart began pounding like a kettle drum. I felt a nervous tick in my right eye. *Easy, Mario. It's not going to end like this. You talk for a living, so talk.* "The reason the Earthmen sent me to your world, Punlaag, was to prevent any wrong being done to your people. If a wrong has been done, it will be corrected, but you must tell us the wrong, make us understand, so that we can go back to the mainland and make it right again."

"Yes. Mistah B'sando. Yes, Missmoodgey. A wrong has been done. I tell you now so you will know. The Mokaltee came to your feast and you did not know him. He will make our rivers boil like the kettle over the fire. He has shown himself so you will know that your metal-place in the sea has offended him. And yet your kind did not see." Punlaag continued to pace, the torchlight dancing in those watery eyes. "Now the sickness will come again. Babies, always, first to die. Then the old, the revered ones. And after many suns, then the young and the strong will feel his anger. I saw this, but you did not see. . . ."

"It was only an image, Punlaag," Doris said, her lips trembling. "An image of the grotuck . . ."

Punlaag stopped pacing and looked directly at her. "Image of Mokaltee, of whom no man can make an image. No, Mokaltee was in the hand of the man who made it. Mokaltee was there." He gestured to the wooden fish hidden behind the torch-bearers. "Just so, Mokaltee is here, watching."

"No, Punlaag," I said. "The cook . . . the man who made the image. He must have seen a picture of a kind of grotuck called the trelph. . . ."

Punlaag raised a two-thumbed hand to silence me. "I debate you not," he said. "You will not believe." He brought his whiskered seal's face close and stared up at me. "But the Mokaltee *will* come. The rivers will boil, as they did before in the time of the ancients. Many of us . . . most of us . . . all, maybe . . . will die. The cause is the metal-place. Spoken to me, it was."

A shivering chill ran down my back. *Think, Mario! What's this all about?* "Tell us, Punlaag. Did this really happen? The trelph . . . the Mokaltee, the little fish with the green on their gills . . . they came into the inland rivers . . . and brought a . . . sickness?"

"You are right, Mistah B'sando. Almost one hundred summers gone, but the memory of it does not end. Weep and pray for the lost generation, we do, every year since gone. The writings tell of the uncounted Mokaltee pouring into the rivers. How first the ancients thought it a blessing of food and plenty. But curse, it was. They soon saw. The water grew hot. At night the rivers gave off blue light. Only those who rowed away to almost starve in the big desert. Only

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those survived." He waved an arm at the crowd of torch-bearers, but I took the gesture to mean the race of Wyntaraag. "We are their children."

A realization was beginning to form in my mind, buried beneath layers of panic. "I think I know what this means. . . ."

Doris looked at me with a question in her eyes. She looked almost numb.

Punlaag blinked his eyes—a rare gesture—perhaps it held the same meaning as an Earthman shaking his head. "No, Mistah B'sando, you don't understand. None of your kind . . . understand. The Kamacaag Clan and the Myraak, they will send emissaries to the Pyrrhus Clan in the big buildings. . . ."

"Yes, they have," Doris said. "They've been talking to my uncle all day. . . ."

". . . but it does not matter," Punlaag continued. "The Mokaltee has been angered. The offense has been taken. The damage is already done. Kamacaag and Myraak . . . they see hope where there is none. The Mokaltee to me spoke the truth. A price must be paid. . . ."

"Punlaag," I said. "Let us go back to the mainland now. I think I understand how the . . . wrong can be corrected. No one need die. It can be prevented. . . ."

Punlaag blinked again, slowly. And when he opened his eyes, two tears streamed down his face. "No, Mistah B'sando. It is for us now soon beginning. But for you and Missmooney, it is now, an end. . . ." He made a gesture to the line of torch-bearers.

I felt the hands of one of the guards grab me by the waist. Instinctively I kicked back as hard as I could and hit something firm. There was a grunt. I spun around and butted my head into the chest of the native holding Doris. To my amazement, he doubled over. "Doris, quick!" I yelled, and we were running for the darkness of the trees.

What happened for the next several minutes was a nightmare blur of tangled images. Branches and vines beating at our faces as we ran breathlessly through the blackness. Tripping, falling, dirt and blood in my mouth. Struggling to find my footing, fighting against the knots that still bound my hands behind my back. Doris's voice: "This way!" Yelling behind us. Lights in the woods. Doris's white scarf swimming through the darkness in front of me. Falling again. "Mario, get up! Hurry!" A pair of luminous animal eyes looking at me from some burrow. "Mario, please!" Standing, running. Crashing through bushes, thorns tearing at my arms. Blackness. The white scarf gone. Running through a line of trees. Falling, sliding, warm mud slipping past my fingers. The riverbank. Doris. The launch. Running lights still on, sedately waiting for us.

Doris was scrambling up the two-step ladder. As I found my feet again, lights were gathering among the trees above us. As I made it to the ladder, something hit the mud at my feet. A short pointed stick, probably poisoned. I was onboard, falling reflexively to the deck.

Doris put the handle of a knife into my hands, as I lay there on my stomach. "Hold this tight," she said, and worked her bonds awkwardly against the blade. In seconds we were both free.

She was climbing the ladder to the

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control cabin when the first native climbed to the boat's railing. He stopped for an instant, fixing me with those big watery eyes. He had a wooden spear in his hand.

Then, with a motion too quick to follow, he threw the spear. It clattered to the deck inches from me. The launch engine screamed to life.

I glanced at the knife, still in my hand. The native was climbing over the railing, his whiskers twitching. He might have been as scared as I. I rushed over and yelled as loudly as I could, showing him I had the knife. In the dim light I saw his eyes widen in fear, but he kept coming. He had swung one leg over the railing. I hit him in the mouth with my fist—an upper-cut on his muzzle with something extra on it from the weight on the knife-handle. He toppled back into the wet mud.

Doris had the engine in full reverse, and with a few shuddering lurches we were backing off the shoal. The channel was too narrow to turn the launch around; she would somehow have to back us down the sinuous route in the dark.

Wavering streams of light were descending the dark banks above us. Wyntaraag words were being yelled back and forth. The short wooden spears were singing in the air around us, mostly bouncing off the resilient composite hull. One more clattered on the deck somewhere near me and I realized finally that I'd better get down.

Crouching on the deck, I could feel our backward motion and the sounds of yelling growing fainter. Once we slammed into something that caused the deck to lean at a frightening angle, but we righted ourselves quickly. Taking a deep breath, I rose to my feet and looked out. The torches gleamed in a little knot some distance away. Apparently the riverbank became impassable somewhere back, preventing the natives from following.

Relief and exhaustion hit me simultaneously. Along with them came pain in my legs, bloody from the falls. My knuckles ached from the punch I'd just thrown. It was the first time I'd hit anyone since the third grade.

When I climbed up to the control cabin we were just backing out into the sea. Doris looked efficient, if not relaxed, at the controls. "Nice job," I said. "You're quite a navigator."

"It was a good thing I'd gone down that river a hundred times during daylight," she said, not taking her eyes off the dials in front of her. "And thanks for getting us out of there. I thought it was all over."

We came about and Doris pointed us back toward the mainland. "What time is it?" I asked.

She glanced at a chronometer. "Almost dawn."

"What's the fastest way to get out to the process platform?"

"The . . . why go out there?"

I sat down beside her and snapped on the chip reader. "We've got to stop that trial run that's scheduled for today. I meant what I said back there. I think I know how the trelph legend came about."

She looked at me, but in the darkness I couldn't read her face. "Well, I guess the quickest route would be back to the mainland and a rocket-bus from the padport."

I scanned through the chip index until

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I found what I was looking for. "Good," I said. "Pour on the knots, Doris. If I'm right about this, those workers out on the platform are in very great danger."

She gave it full throttle and we began to cut a phosphorescent wake. "Mario, are you going to tell me what this is all about?"

I raised a dirt-smeared palm, engrossed in the text on the reader screen.

She leaned over and peered at what I was reading. "*The History of Industrial Contact* . . . I don't see . . ." We both read silently a few minutes more, then I snapped the reader off.

"Oh, my God!" Doris said.

On the horizon the first pink light of Priam was diffusing into the sky.

The dock crews were reporting to work as we roared into the harbor and glided expertly to the pier. We got more than a casual glance from the crane operators and stevedores in our mad dash to secure the launch and find an autocab.

The stone and glass of the Pyrrhus complex sped by the cab windows, as we were both catching our breath. "We're quite a sight," Doris said, looking at our torn and mud-smeared clothes.

It was one of those moments in a crisis when one realizes that nothing he can do at the moment can improve the outcome. We would either reach the pad-port before the morning rocket-bus departure or we would not. I looked at myself and then at her, suppressing a chuckle. In a minute we were laughing in each other's arms.

The cab streaked to a stop at the port's main terminal entrance and we found ourselves with only two minutes to spare.

"We'll never make it," Doris said. "The last tram to the bus pad must have left by now. It's a couple of miles."

"How about an airvan?" I asked as we jogged through the air-curtain at the terminal entrance.

"To the pad? Sure, but where do we find one?"

I stopped in front of a row of public viewphones and fished in my pockets. "I'm going to call your uncle. Maybe he can delay the trial run." *Damn!* I was still in the dirt-encrusted clothes from the launch. "Have you got a credit on you?"

Doris felt in her pockets and a helpless look crossed her face. Then her face brightened: "Free-call emergency number!" She pointed out the code sequence listed on the side of the viewphone.

I punched the numbers furiously. On the screen a sleepy-looking male face appeared. "Please state the nature of your emergency," he said.

"I must contact the office of Tobias Mooney of Pyrrhus's General Offices."

The man squinted at me and I suddenly realized what kind of appearance I presented. "This is an extreme emergency!" I said. "I am Mario Brisando of the New Coalition Office for Planetary Indemnity."

He seemed taken aback a little by that. "Voiceprint identification will be required. Please read the following sentence slowly and distinctly."

"We don't have time. . . ." But the man disappeared and a line of words appeared on the screen.

I went through the ritual: "The quality of mercy is not strained . . ."

After more procedural details, I found

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myself talking to Tobias Mooney's secretary.

"I'm sorry, Mr. Brisando, but Mr. Mooney is out on the process platform this morning. Can Mr. Edmunds be of any help, ?"

My heart sank. "Is Mr. Stevens, my superior, there, by any chance?"

"I believe Mr. Stevens went out to the platform with Mr. Mooney. There's to be a small ceremony, I believe. . . ."

"Listen carefully," I said. "It is imperative that I get out to the platform before the trial run of the process begins. Mr. Mooney's niece and I are at the pad-port terminal, but we've missed the morning rocket-bus. Can you arrange transportation?"

Certainly. I'll call the pilot's lounge out there immediately. Go to Gate C and identify yourself." She snapped off with a warm smile at the chance to demonstrate her efficiency.

When we reached Gate C we were told to wait a few minutes. My pulse was racing again and neither of us felt like sitting down.

Mr. Brisando! Glad to see you again!" To my astonishment it was Casey, picking his teeth with a toothpick. His expression changed when he saw our dishevled state. "Looks like you've had a bad night."

We had the time to clean ourselves up a little in the luxurious board-room facilities of the pterocoach. I opened the wet bar then and poured us both two stiff drinks.

"Thanks," Doris said, taking the glass in both hands and taking a big sip.

I plopped into one of the plush swivel-chairs and set my glass down on the huge wooden table. "What is your uncle like, Doris?"

"You mean, will he believe you?"

"How much of an emotional stake does he have in the success of this project?"

Doris thought a moment. "Enough to deny the truth until it's too late, I'm afraid."

I rested my elbow on the screen monitor, where Casey was showing us the cloud-tops on this overcast day. "Then I've got to talk to Mark Lassiter. I believe he is a good engineer and a realist. He'll listen."

"But will he stop the run if Uncle Tobias orders him to go ahead with it?"

The sea glimmered in morning light through a small opening in the cottony cumulus. *I'm supposed to be good at reading character*, I thought. *It's part of my training and part of my job.* Mark Lassiter was obviously intelligent and competent, but he too had an emotional stake in this project. In his case, it wasn't just personal ambition; it was a certain professional pride. The process platform was his baby—I had seen it in his face and in his tone of voice. He was also a company man, though how deep that ran was hard to assess.

"Mario?"

I responded with a grunt under my breath.

"You're daydreaming. I asked you if you thought that Mark Lassiter would stop the run if my uncle orders him to go ahead."

I looked at the clouds on the screen. "No, he won't," I said.

"You've got to be kidding!" Mark Lassiter's face was red, and not just

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from the sea-wind whipping at us on the platform's landing pad.

The three of us stood there a moment as I let my first words sink in past the initial reaction. Then I looked him straight in the eyes. "I'm deadly serious, Mark. You've got to abort the run today."

Tufts of blond hair were beating at the rim of his hardhat. "When the pilot radioed that you were coming out this morning, I never suspected . . ."

"Look," I said, "can we go inside somewhere and talk?"

"Sure, my office . . . but listen, I want you to understand that we're already running . . ."

Doris let out a gasp.

I felt my adrenalin level take a giant leap. "How long?"

"We just started the pumps a half hour ago. We're working on a large school of grotuck. . . ."

We had stepped on a moving walkway which was taking us in the general direction of the administration building. I increased our pace with a slow run. "Have you got some sort of radiation detection equipment?" I asked.

"Radi— Yes, ah, scintillation counters on some of the ion exchange stages. There's a naturally occurring radioactive lutetium isotope that comes off in small amounts, and we get a little uranium. Now look, Mario, you've got to tell me what this is all about."

I was panting now as we neared the building's main entrance. "Let's get those counters! I'll tell you what I know as we go along." I tried to make my voice sound convincing between gulps of wind: "There's going to be a lot of dead people on this platform . . . if you don't shut those pumps down soon!"

I could tell Lassiter wanted to stop and stare at me in disbelief, but I kept us moving.

He was puffing now to catch up to Doris and me. "Mario, just what the hell are you talking about!"

I pulled on the release and the glass doors of the administration building slid aside for us. "It's the trelph," I said.

"The trelph? The neuter grotuck? What could . . ."

"Not neuter," Doris interjected.

"No," I said, "and right now, quite deadly for everyone on this platform."

A receptionist sat at a metal desk in the small lobby. Our wild entrance must have made her want to sound some kind of security alarm, but she calmed visibly when she saw Mark trotting behind us.

"Now just a second!" Mark said. It was obvious we weren't going any further until I told him more.

"Okay," I said, speaking hurriedly. "Over a hundred years ago, before Priam IX's gold-rush days, some utility cartels in the Spica System were looking for a nearby place to dump some high-activity fissile waste. In those days a lot of the colonies with abundant uranium ores were resurrecting the old fission power reactor technology. The deep ocean trenches on Priam IX—like the one right beneath us—is where they dumped the waste.

Mark put his hands on his hips and took a deep breath. "Our deep-ocean surveys didn't show any radiation in these seas."

"Did you check the sea floor in these trenches?"

He pulled his hardhat back on his

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head. "No, of course not. We surveyed down a few kilometers, but these trenches are *deep*."

"The trelph live down there, though," I said. "My guess is that a lot of that waste has diffused out of its containers. The trelph are concentrating the fissile part of that in their bodies."

Mark let slip a flicker of a smile—tolerance for the layman, possibly. "Even if the trelph could somehow extract only uranium-235 and even if we started pumping up nothing but trelph, we'd never reach anything like a critical mass in the intake tubes. At less than about forty percent concentration—the amount needed for criticality . . ."

"I know," I said. "But the Spica utilities were using a really ancient technology—they had billions of tons of high-grade uranium ore lying near the surface on their worlds. There was no need to have to put up with the dangers of breeders and plutonium recycle. . . ."

Mark's expression turned serious. "So you're saying the waste they dumped here is loaded with plutonium."

"Right. And all the long-lived isotopes of plutonium are fissile."

Mark rubbed his ear. "Wait a minute, let me think about this. The grotuck have been assaying out at about three percent fuletium on a weight basis. You're saying that the trelph could contain about the same percentage of plutonium." The smile flickered again. "Even if that's true—and I'm not saying I believe it—it doesn't make a bomb, my friend. Do you realize what it takes to design . . ."

"I didn't say a bomb! Look, Mark, I worked on an indemnity case once that involved an old-fashioned breeder fuel processing plant on Aborax. It was an antiquated manual operation using glove boxes. Not very good accountability. Somebody got a little too much plutonium in the same place at the same time. It wasn't a very big explosion—maybe equivalent to the detonation of a small land mine. The fissile material gets blown apart before anything really big can happen. But it tore a huge hole in the side of that processing plant and the radiation killed everybody working there."

"A squib reaction," Mark said, serious again. "Yeah, I know what you're talking about. A fast shower of neutrons and gamma rays and a lot of dirty stuff gets blown around. But you haven't convinced me that it could happen here."

Frustration was welling up inside me. I could feel my palms starting to sweat. "Look, Mark," I said, "a hundred years ago, the Wyntaraag who live along the rivers were almost wiped out by schools of trelph. The male and female grotuck must have swum into the coastal channels to mate. Then they sent out the pheromone that attracted the contaminated trelph. In the narrow channels enough trelph got close enough together in the frenzy produced by the pheromone to produce high radiation levels in the water. The blue glow . . . what is it. . . ?"

"Cerenkov radiation . . ."

"Thousands of the Wyntaraag died. It's become a terrible folk-memory that's now part of their religion."

Mark knitted his brows in a pensive frown, looking away from us. "Okay, hold on. The trelph are supposed to be

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extracting the plutonium and concentrating it in their specialized organ, where the lutetium normally accumulates. But plutonium is incredibly toxic, as well as a strong alpha-emitter. Why doesn't it kill them?''

''I'm not sure,'' I said, ''but I can make an educated guess. The trelph have a unique anatomy that allows them to rise from great depths relatively quickly.''

''Yeah, I know; Sissman wrote some papers on that, I believe.''

''It involves rapid cross-linking of certain special polymeric compounds to toughen their tissues and enable them to withstand what would otherwise be explosive decompression.''

''Okay, so what?''

''So did you ever hear of radiation curing of polymers?''

''You mean that radiation from the plutonium cross-linked the polymers in their specialized organ.''

''Effectively sealing off the stuff in that one place in their bodies, like encapsulating it in a dense plastic. The alpha is stopped and the metal is kept from migrating to any vital points in their bodies.''

Mark squinted at me. ''You seem to have thought this through, Mario. But you still haven't convinced me that my plant is in any kind of dire peril right now. If the trelph are really contaminated, maybe we've got some redesigning of the process in store for us, but . . .''

My face flushed. ''You're the engineer, Mark. How much fissile plutonium are you pulling into this plant right now?''

The look on his face was suddenly not very friendly. But he raised his wrist calculator and started punching numbers. Suddenly his expression changed again. He stood a few seconds, staring numbly at the display. ''What's the mass limit for plutonium, anyway?'' he said.

''I looked that up,'' I told him. ''Two kilograms for pure material in close proximity. But it increases slowly with dropping concentration. At one or two percent concentration, it's still something like twenty kilograms. That's under *optimal* conditions, of course. The geometry has to be such that significant numbers of neutrons can't escape. But those intake tubes of yours are *wide*. And water is a reasonably good reflector. And the carbon in the grotuck themselves is an even better one.''

He continued to stare at the lighted display on his wrist.

''What is it, Mark?'' Doris asked, finally. ''How much plutonium is there in the pump intakes?''

''If a full third of the grotuck we're pumping are trelph,'' he said, ''. . . about five thousand kilos.''

''We're wasting time!'' she almost yelled.

Mark didn't move. His gaze was distant. ''There's something else,'' he said.

My mouth was so dry now I could hardly swallow. ''What else?''

''Those intake tubes . . . early in the design stage of this plant they knew they were going to need a strong light alloy for those tubes. They knew they had to use local materials. No problem, of course; Priam IX is a metallurgist's dream. They made the intake tubes out of a beryllium alloy. . . .''

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This time *I* had trouble understanding. "Does that mean something?"

"Beryllium is a neutron reflector—one of the best. . . ." Mark Lassiter looked at me, incredulity and shock now visible in his features. "If only those pipes weren't so big . . . We're talking about five thousand kilograms of plutonium in a beryllium-walled cylinder 30 feet in diameter. There's all kinds of other factors involved . . . I don't know . . . I'm not a nuclear specialist. Maybe nothing will happen."

"Are you prepared to risk the lives of everybody on this platform?" I asked him.

"Mark," Doris said, a tremble in her voice, "you've got to shut this process down. Nothing is worth that risk."

He looked at her and then back at me. "If I shut those pumps down at full load, I'm liable to set up vibrations that'll wreck this plant. If we're wrong . . ."

"Get those counters then!" I yelled at him, right in his face. It seemed incredible after all this, but only some kind of physical proof was going to convince him. "Let's get moving!" I said.

Mark's first impulse was probably to deck me right there in the lobby, but instead he blinked once, returning my stare in silence. "Come on, then," he said, and he was off like a shot with Doris and I running close behind.

We slammed through some double doors that said "No Admittance" and down a long carpeted corridor of offices and meeting rooms. At the far end was a door that led to the outside.

"Stay close," Mark yelled over his shoulder. "I don't want you getting lost." Then he hit the door release and a rush of sea wind and chemical smells hit us.

Suddenly we were in the working part of the plant, running ant-like beneath gargantuan tanks and machines. A workman reading gauges stopped to look at us in bewilderment, almost dropping his clipboard. He called something to Mark as we ran past.

"Can't now!" Mark yelled back.

I caught a quick glimpse of Doris running at my side. Anguish. Exhaustion. Fear. I seemed to read them all in her face. *Why did I get her involved in all this? A grad student. A kid, little more than half my age.*

And then I glanced again and she caught my eye and smiled a warm brave smile.

As we neared a massive bundle of pipes that rose up before us like an inverted waterfall, I first became aware of the sound of the pumps. On my tour (was it only yesterday?) this place had been silent. Now a low-frequency thrum coursed through the place. Deep and resonant, like the opening note of *Also Sprach Zarathustra*. Strangely ominous. I could feel it through my shoes.

Mark led us through a narrow gap between two tanks the size of small buildings. We had to step gingerly through a tangle of black plastic hoses. Some of them were slowly seeping an amber-colored, foul-smelling liquid. Then more running—past some banks of accordion-like rows of metal fins: heat radiators of some sort. Finally we reached the base of one of the big ion exchange towers.

All the while, the noise of the pumps had grown steadily. By now it was deafening.

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"Wait down here," Mark yelled over the din. He began to climb an enclosed ladder up the side of the tower.

Doris looked at me while we waited, not attempting to talk in the all-pervading roar. I took her hand and squeezed gently, attempting my own version of a confident smile.

"Here they are," Mark called, sliding down the rungs like a spacehand. He showed us two pen-like devices with dials on the end. "Best place to check would be right at the pump intake manifold. We'd better get some ear protection."

A few hundred meters, past the calciner and the ultrasonics, through a roar that became a physical presence. Mark removed some earplugs from a wall receptacle. "Here," he said, putting metal rings around our necks. "These are throat mikes so we can talk."

The earplugs cut out most of the noise, but I could still feel the power of those pumps. "Okay?" Mark said, inside my head. Doris and I both nodded.

He led us up a flight of metal stairs and out onto a catwalk along the side of a three-story-high machine that I took to be one of the pumps. My feet tingled with each step. Fifty yards later we reached the intake side of the pump, where a conduit thirty feet in diameter ran out a ways, then curved abruptly downward through an opening in the floor of the platform. The catwalk ran out a short distance onto the top of the conduit.

"This is as good a place as any," Mark said, doing something with one of the radiation meters.

I heard a crackle in my head. "Sorry," Mark said, "The transmitter's picking up some static from this thing."

I looked over his shoulder at the dial he held in his hand. "Nothing," he said. "No, wait . . . I'm getting some gamma . . ." The needle took a spasmodic leap, then settled again. "I wonder . . ."

Then suddenly the needle leaped again and pegged itself against the far side of the dial. "Oh, my God!" Mark's voice said inside my head. He turned a small knob. The needle remained where it was. "This pipe's screaming with gamma!"

Mark led us by the shortest possible path to the Process Control Building—a furious obstacle course race up and down stairs and ladders. As we burst in the door, five technicians swung around in their chairs.

"Harry! Emergency shutdown! NOW!"

Doris and I almost doubled over from the pain in our ears. Mark had left his throat mike on. We yanked out our earplugs.

Oblivious, Mark was throwing switches and giving orders. "I want vibrational analysis on the pumps fed in here on a real-time basis. Send a crew out to install a gamma monitor on each intake . . ." The technician named Harry looked at him in bewilderment. "Tell them to tear 'em off the ion exchange stages—direct read-out here . . . *Move!*"

Banks of indicator lights that had been green or blue were changing rapidly to red. A warbling alarm came on. The technicians were moving hurriedly between the consoles and wallpanels; some were speaking into headsets.

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"I want nine on the big screen!" Mark said. Seconds later the huge holoscreen came to life with what looked like an animated blueprint of the pump we had just left. It was obviously a computer-generated drawing from real-time inputs. As Mark tapped in some codes from the keyboard in front of him, the picture zoomed in to an "X-ray" of what I took to be the rotating vanes and shaft of the pump. "Give me a simulated strobe at 500 Hertz," Mark said. The whirling blur slowed and resolved itself into a helical cage of curved blades. "Supe the loading factors." A table of changing numbers appeared in the lower corner of the screen.

"Mario!" Doris was tugging at my torn shirt sleeve. "I just thought of something!"

I tore my gaze away from the screen. "What?"

She looked at me uncertainly. "I'm not a physicist . . . but I thought . . ."

"What is it, Doris?"

"Well, those high gamma readings at the pipe. Plutonium emits . . . alpha particles. They should have been stopped by the metal of the pipe wall. . . ."

I tried to look reassuring, but couldn't manage it. "That's right," I said. "There must be enough trelph in the system now for fission to be occurring already."

"But then . . ."

"The danger is that enough trelph will get together for a burst of sustained fission. Milliseconds'-worth is probably all it would take. Then there will be a flash—the pipe will be vaporized and a fast shower of neutrons and gamma radiation will be blown out."

She bit her lip. "And . . ."

"And everybody on this platform will be dead."

"Picking up microcracks at coordinates nine-eleven . . ." Mark was calling out. "How are those guys doing with those counters?"

The technician talking into a headset at the far side of the room made some answer I didn't hear.

"Well, tell them to get their asses out of there, then," Mark said. "That pipe is hot. And put up the readout as soon as you have it!"

It was then I noticed something—a high-pitched whining sound that seemed to be coming from everywhere all at once. *The pumps shaking themselves to pieces.*

"Intake pressure down to 450," Harry said. "I can give you the radiation data now."

A second table of numbers appeared on the screen and Mark squinted at it. "That's pretty high, I think. Give me seven for a second!"

The holoscreen image changed. It was the underwater scene I'd seen on the tour visit. Large open pipes bathed in eerie light. But now a great dark cloud filled more than half the screen. It rolled like a huge thunderhead, funneling into the metal openings. Strokes of lightning flashed at its edges as the silvery-orange bodies of the grotuck caught the light from the spots.

The whine was rising in pitch and intensity. "Intake pressure down to 300," Harry said. "We're loosing camber in the primary vanes."

"Nine again," Mark called. The animated blueprint reappeared. The helical cage was beginning to contort itself. "Gamma level's still rising. Damn, I

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wish we had a nuclear engineer out here!''

''Intake pressure at 250. Microcracks all over the place,'' Harry said.

''Seal up the secondaries.''

''The vanes'll go!''

Mark glared at him. ''The plant's wrecked anyway! I don't like these radiation level readings.''

At that moment the door flew open and a crowd of people in business attire stormed in. ''Lassiter! Have you gone mad!'' It was Tobias Mooney, his face wild with outrage and disbelief. Over his left shoulder I noticed Stevens, looking bewildered.

''Get out of here, Tobias!'' Mark said. ''We're in trouble!''

''Intake pressure down to 100 . . . 75 . . . 50 . . .'' Harry was keeping his eyes on the gauges in front of him.

Tobias Mooney pushed his way past Doris and me and grabbed Mark by the arm. ''You've destroyed this plant!'' he bellowed. Mark pulled away to study the screen.

''Vane failure on number one primary!'' Harry called.

''You'll never work again, Lassiter!'' Mooney was red-faced and almost screaming. ''I'll see to that!''

Doris rushed up to her uncle. ''Mark's trying to save our lives!'' she said. ''The intakes are full of . . .''

''Doris!'' It seemed that our presence in the room finally registered with Mooney. ''What are you and . . . Brisando, is it? What are you two doing out here?''

Stevens now stepped out of the crowd of officials. ''Yes, Mario. I think you'd better explain yourself right now!''

''Vane failure on number two primary! Intake pressure at 20, dropping fast!'' Harry and the other technicians were doing a remarkable job of ignoring the intrusion. ''Shaft failure on three. Superstructure holding . . .''

Doris and I were trying our best to explain about the trelph.

''I've never heard such nonsense!'' Tobias Mooney said. ''Lassiter, you believed this drivel?''

''System pressure at baseline,'' Harry announced. ''No pipe failure!''

A cheer went up from the technicians around the room.

But Mark remained serious, his eyes glued to the screen. ''Radiation still increasing,'' he said. ''How can that be? We're not pumping any more trelph!''

I walked over beside him, ignoring Mooney. The little table of numbers clicked inexorably upward. ''The trelph. They're in an excited frenzy from the pheromone—they must be swimming into the pipe on their own.''

''What are you two talking about!'' Mooney yelled. ''Stevens, what does your man there have to do with all this?''

''Ah . . . yes, Mario! I demand you explain right now!''

Mark Lassiter was in a kind of daze which none of this could penetrate. ''But we stopped the flow of pheromone when we stopped power to the pumps!''

I looked into his glazed eyes. ''You forget that the system is full of grotuck—male and female, all in heat and all generating the pheromone. The trelph are swimming into the pipes like salmon fighting their way upstream to spawn!''

His eyes widened suddenly. ''And with the system blocked by the dead

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pumps, we're going to reach critical mass at each pump manifold!''

On the screen the radiation counts steadily mounted.

''We've got to evacuate this platform and fast!'' I said.

Mooney raced over at that. ''*Just who do you think you are, Brisando!*'' But that was the last thing he said, because Mark Lassiter had cold-cocked him with a hard right to the jaw.

Fire sirens were the only general alarm on the platform. They were blaring loudly when Doris and I reached the landing pad. The pterocoach pilot, Casey, was waiting for us, a nervous look on his face.

''What's up?'' he asked. ''I just got a call from somebody saying the whole place has to be evacuated.''

I explained the situation in words of one syllable between gulps of breath.

''That's trouble,'' he said. ''The rocket-bus left a half hour ago!''

''Radio them back,'' Doris said. ''There are two hundred people that are converging on this pad from all over the platform. We can't leave anybody behind!''

''How much time do we have?'' Casey asked. ''There's a back-up 'bus in the hangar. I haven't been checked out on them, but I can fly it.''

I looked at the youthful face beneath the blond beard. ''There's no rocket-bus pilot on the platform?''

''Not now. The next scheduled run was to be at the shift change.''

''We haven't time to call the last 'bus back,'' I said. ''You'll have to fly the back-up.''

''Right,'' he said, but there was just a trace of a quiver in his voice. ''I'll get her warmed up.''

Two hundred people was twice the rated passenger-load for the rocket-bus. The seats had been folded back into the floor of the passenger compartment and the flooring was packed solid with humanity, all sitting with their arms hugging their knees in emergency ''crash'' position.

Doris was at the hatchway with the personnel roster that Lassiter had given us. ''That's it,'' she said. ''Everybody's here except Mark, himself.''

I stuck my head through the open door to the pilot's cabin. ''Just one more and we'll seal the hatch.''

Casey was running through the preflight checklist for the third time. He nodded in acknowledgement without turning his head.

I looked down the irregular rows of heads—engineers, office workers, tradesmen, journeymen-laborers . . . management. There was Tobias Mooney, nursing a swollen jaw and still fuming mad. He was surrounded by his subordinates, but they didn't speak to him for fear of incurring some of the wrath he was nurturing for Mark and Doris and me. Stevens was seated at the periphery of this group, trying to look dignified and probably wondering if he should fire me or wait until he took a ''sounding'' from government headquarters.

''Here he comes,'' Doris said, checking off Mark's name on the list.

He was puffing and red-faced as he climbed aboard. ''I took some readings at different places along the pipes,'' he

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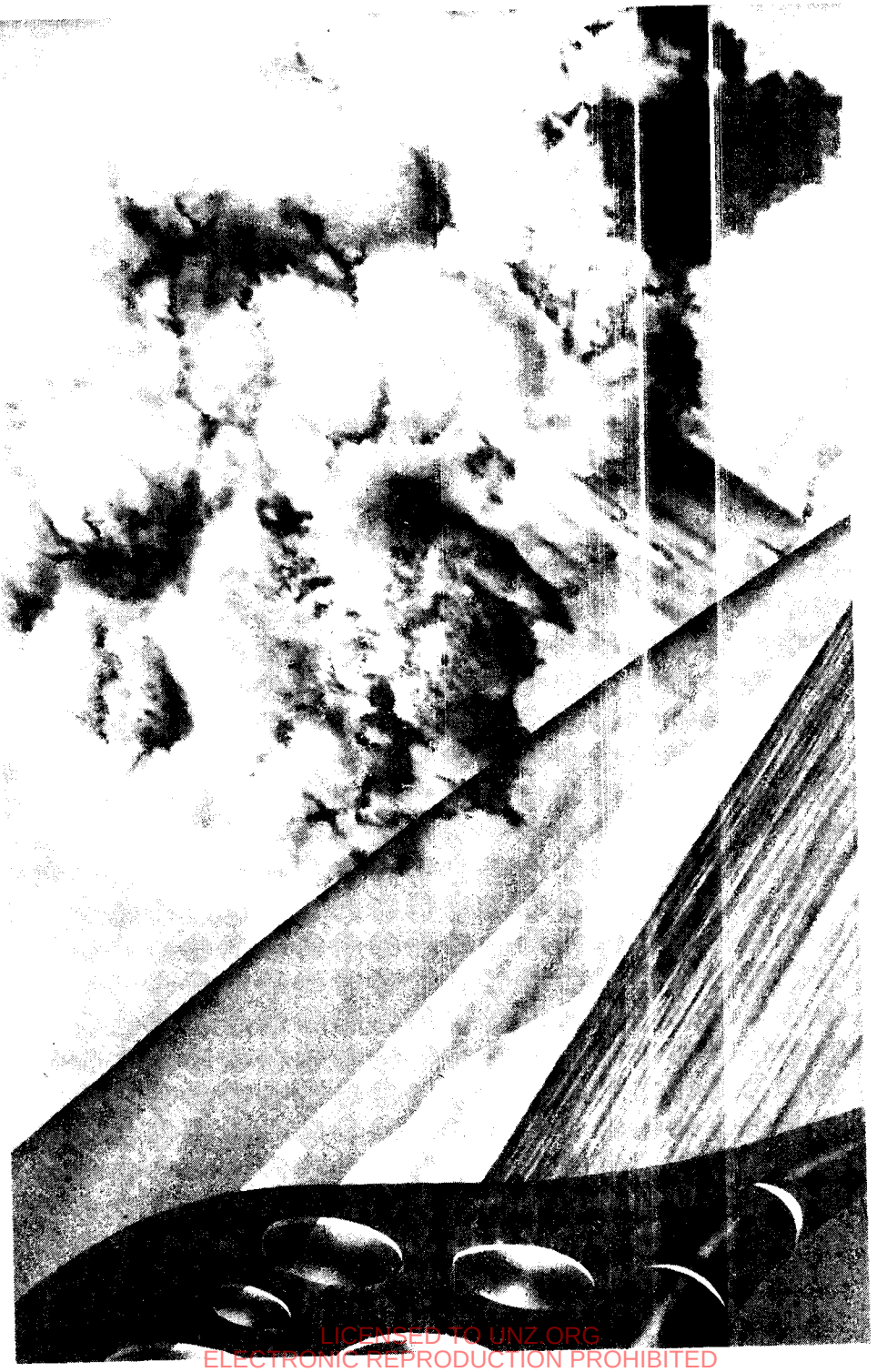

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said. "Everything's screaming hot and getting hotter."

Doris and Mark dogged the hatch. "Okay," I yelled to Casey. "Let's get out of here!"

He nodded and the sudden lift knocked me to the floor. Doris and Mark just managed to ease themselves down in time.

"Keep the 'bus engines between us and the platform," I yelled to Casey. "All that metal will act like a radiation shield in case it goes!"

I saw the back of his head nod against the sky and clouds in the windshield. We were still climbing as he arced us away from the platform.

Doris was seated with her back against the hatch. She was studying me through her own exhaustion; perhaps she didn't realize she was staring. I wondered what it was she saw.

Then there was a flash of light, whitening the sky in the windshield.

Casey's hands remained steady on the controls.

"We made it!" somebody among the crowd of passengers said. It might have been Harry, the technician.

Suddenly everybody began talking at once, and I realized how silent they had all been.

Doris inched her way over to me. There were tears in her eyes.

I looked over at Mark. He was staring at the floor, lost in thought. Then I turned around and picked out Stevens's face in the sea of people.

"Mr. Stevens!" I called out and I saw him notice me. "I resign!"

I saw his mouth moving, but I looked away and didn't hear.

I took Doris in my arms and kissed her. She was weeping now against my shoulder. "Maybe," I said, whispering into her ear, "maybe there's still time to chase a few rainbows." ■

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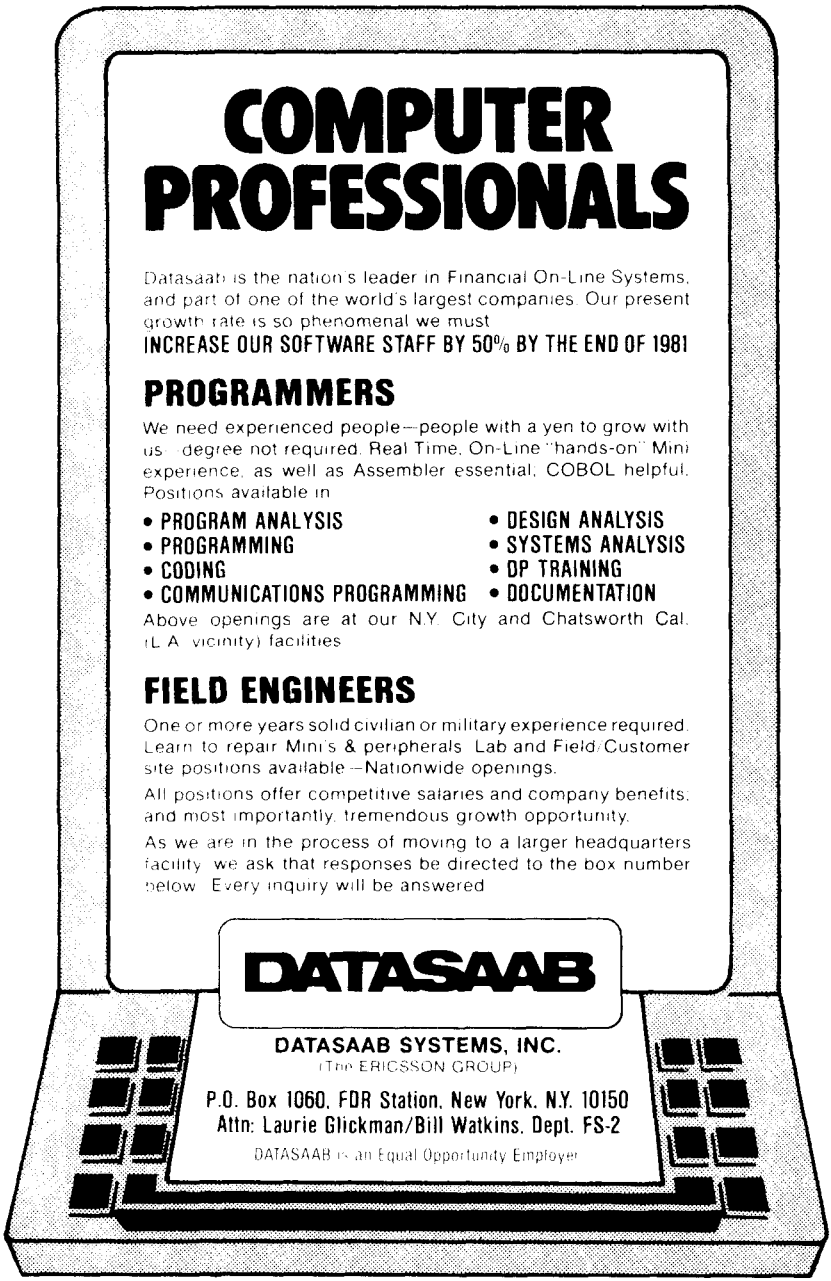

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John Gribbin

Do we owe our domination of the Earth to someone else's catastrophic demise? And might we lose it the same way?

BASE EIGHT ARITHMETIC, METEORS AND MAN

Why does our arithmetical system use the base ten? Obviously, it is because we have two hands each, and each of those hands has five digits on it. There is nothing sacred about base ten arithmetic, and if, with a little imagination, we envisage an intelligent life form with four hands each having three fingers, then logically we might expect that life form to count in twelves. On the face of it, assuming that intelligent beings start to count by using convenient parts of their manipulating limbs as markers, there are endless possibilities for other life forms to base their arithmetic on.

But how many of these are actually practical possibilities? To start with, would it really make sense to have four arms each with three fingers? In evolutionary terms, probably not—at least as far as intelligent life is concerned. Bilateral symmetry, with limbs paired on either side of the body, is clearly a successful evolutionary invention. Legs each side help you to stand up, and an odd number of true legs cannot be conveniently fitted into this pattern, although some monkeys have a grasping tail, and the kangaroo uses its tail as a prop. Once legs to stand on and move about with have been "invented," it is a logical evolutionary step to adapt some of those limbs for manipulating things. In our case, this means that the other pair has been adapted for walking on, which just

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leaves the two hands free. We should be cautious about reading too much into this, since after all our cousin-apes, the chimpanzees, make considerable use of their "feet" for grasping, and would probably regard base 20 as "normal" if they were bright enough to invent arithmetic. But *really* accurate manipulation involves good eye/brain/hand coordination. That is now thought to be a major reason why the human brain developed, and such coordination works best with the limbs nearest to the eyes, at the front—or top—end of the body.

There is also a principle called "maximum parsimony"—a variation on Occam's Razor—which says that it is advantageous in evolutionary terms to make the minimum adaptation needed for success. An extra pair of arms might be useful occasionally, but the occasional advantage has to be offset against such mundane aspects of everyday life as the need to eat more food to provide for those arms and the doubled risk of breaking a manipulating limb and being disabled. Whatever the reasons, all the successful species on Earth which go in for manipulating limbs—even species with six or eight limbs—always set aside just one pair for the purpose. The crab has two large pincers at the front, the kangaroo has two arms, and even a mouse uses its front pair of limbs for holding food. This makes sense. With bilateral symmetry and eyes at one end of the body, obviously one pair of limbs will be most useful for grasping and moving things.

Leaving aside wild speculation about life in the clouds of Jupiter or on the surface of a neutron star, we might begin, on this basis, to decide just how far our own shape is determined by the conditions under which our ancestors evolved. Are we, in fact, typical of the kind of intelligent life to be found on Earth-like planets? What are the chances that, if ever we do make contact with intelligent beings that have evolved under similar conditions, they too will be upright, bipedal animals with two arms, each ending in a five-fingered hand, and a head mounted on top of the body carrying a pair of eyes, a nose and a mouth?

To start with, intelligent life—the kind that builds civilizations and spaceships, that is—can't be otherwise too successful in being adapted to its own natural environment and must have been, during its evolution, under considerable pressure from predators. The elephant is intelligent, by some standards, but so powerful that it is insulated from the dangers of attack by enemies and never had to use its intelligence to fight off enemies. The whale and dolphin, potentially as intelligent as man, also have few enemies and are superbly adapted to their watery environment. The price they have been obliged to pay is streamlining and a total absence of limbs and hands that can be used to manipulate objects. A whale may sing, but he could neither construct nor play the cetacean equivalent of a saxophone or piano.

The point is not unimportant. Intelligent, tool-using life will emerge on a planet like ours on the land, not in the sea. It won't be very big or fierce, since big, fierce animals have no need to invent tools or weapons, or to sharpen

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their cunning by hiding from predators. And it will have a pair of limbs at one end, conveniently near the eyes and ending in digits (fingers) that can be used to grasp and manipulate small objects.

The picture already begins to look very much like a primate: a ratlike or squirrellike creature good at hiding and scurrying out of danger, with sharp eyes and good hearing to detect danger coming, and not so big that hiding or running away becomes difficult. What about more legs for running away with? The centaur, half horse and half man, looks at first quite a good bet. But there is a snag. The bigger the body, the harder it is to hide and the more food it needs to survive. A centaur is heavily committed to running, rather than hiding, as a defense, and in evolutionary terms that means that the pressures of natural selection will operate to produce more horselike centaurs, with the human-like limbs withering away into ever more useless appendages. No, apart from the kangaroo's tail, it is hard to see how we could improve on the basic design of two legs for running with, two arms with hands for carrying things, and a head mounted on top carrying two eyes to provide a stereoscopic, three-dimensional view of the world. Three-dimensional vision is essential for judging distances—whether it's the distance to a charging lion or to a morsel of food waiting to be picked up; a good high mounting for the eyes is essential for a prey animal, which needs an early warning of impending danger. The necessity of an to breathe and food to eat complete the outline design, requiring a mouth and a nose of some description, although maybe a few variations on those themes are possible.

At a quick glance, even trying to avoid any cultural bias from our everyday experience, it looks very much as if the bipedal design is the right one for intelligent life on Earth. The only real room for variation is in the number of fingers on each hand. Five is certainly a useful number, as we all know. But it does seem to be on the high side of usefulness. It is difficult to see how an extra finger on each hand would be very beneficial, while, by contrast, many people who have suffered accidents leading to amputations manage very well with only two or three fingers on a hand. The key, in those cases, is that they still have a thumb with which to oppose the remaining fingers, making it possible to grip and manipulate objects dexterously.

So far, all this is speculation. As yet, we have no information about life on other planets with which to test the idea that intelligent Earth-type life is bipedal and, broadly speaking, manlike. What we need is one test case. If we landed one robot probe on one other Earthlike planet and found the dominant life form to be an intelligent biped with four or five fingers on each hand, the argument that this is the inevitable product of evolutionary selection on such a planet would be overwhelming. The chance of such similarities arising by coincidence is so small as to be virtually negligible.

Unfortunately, the chance of landing a robot probe on another Earthlike planet in the immediate future is equally small. But wait—this isn't the end of the story.

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We do have information about one planet under conditions that were undeniably Earthlike but on which there was no human life. I refer, of course, to the Earth itself, during the era of the dinosaurs. If the arguments I have sketched out above hold water at all, then the pressures of natural selection, operating during the era of the dinosaurs just as they have in the subsequent 65 million years of Earth history, should have been acting to produce an intelligent, upright biped.

Now, during the 150 million years or so that dinosaurs dominated the Earth, the evolutionary pressures were, in many ways, less than they have been since. In particular, the climate was more stable than it has been in the past few million years, and because of the geographical arrangement of the continents (which changes over millions of years, due to continental drift) there were no great Ice Ages to weed out species and put a premium on intelligence and adaptability. The recent cycle of Ice Ages, according to most evolutionary theorists, played a key part in forcing man to adapt to changing conditions, putting a premium on intelligence and flexibility, and making us what we are today. That is why man has evolved so rapidly.

But even with less pressure on the dinosaurs from the environment, surely intelligence would still be an advantage? And surely over 150 million years even relatively gradual evolutionary changes would have had a chance to get to work?

Indeed they would. Although most people think of dinosaurs as great lumbering brutes with tiny brains, in fact the term applies to a variety of creatures as wide as the variety covered by the term mammals today. There were big, stupid dinosaurs, but there were also small, agile dinosaurs. There were meat-eaters—the dinosaur equivalent of lions and tigers—and there were grass eaters—the dinosaur equivalent of deer and sheep. Think of any variation on the mammal theme today, and the chances are there was a dinosaur equivalent. And the dinosaurs didn't even die out without a trace, whatever the impression most popular accounts provide. Dinosaur descendants are alive and well on Earth today: not just in the form of obviously reptilian creatures like crocodiles and alligators, but also in the form of birds, products of a highly successful dinosaur line that took to the air (as well as developing warm blood, a trick emulated by other dinosaur lines). Out of all that variety, were there no dinosaur candidates for the bipedal, upright niche that, according to my argument, marks a vital place on the road to intelligence? If the fossil record showed no sign of a dinosaur even remotely human in appearance, we would have to admit that the idea falls down; but if there were dinosaurs that could be described, in the broadest terms, as on the path to humanlike appearance, then it would at least make the argument look a little more plausible.

In fact, there were several dinosaur types which followed, broadly speaking, the kangaroo's approach to bipedalism rather than the human approach, keeping a large tail which could be used as a stabilizer, weapon, or seat. That's no problem; a biped with a tail is still

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a biped. Tyrannosaurus and Iguanodon carried this design to extremes, reaching five meters in height. One a flesh-eater, the other herbivorous, neither of them could be said to be intelligent. Sclerormochlus, a bipedal reptile about one meter long, which lived about 200 million years ago, is superficially a more likely candidate for the pre-intelligent niche, but had a small brain and never seems to have made the grade. But there is a star candidate who fulfills, as far as we can tell from the fossil remains, all of our requirements. If you landed on a distant planet and were greeted by a creature like Saurornithoides, you would have to admit that the argument that Earthlike planets produce manlike intelligent species held water.

A Saurornithoides was a smallish dinosaur, weighing about 50 kilos, which lived at the end of the age of the dinosaurs some 65 million years ago. They had the largest brains, in proportion to body mass, of any dinosaurs, with a brain-to-body weight ratio not far different from that of the modern baboon. And they were clearly active bipedal creatures, with a long tail behind and four-fingered hands at the end of each arm, the fingers perhaps being arranged as two true "fingers" with an opposable "thumb" on either side.

This is a pretty impressive set of credentials. Starting from this basis 65 million years ago, if Saurornithoides had followed the same path, in response to similar evolutionary pressures, that the equivalent pre-humans were to follow 60 million years later, then it might well have been possible for a Saurornithoides civilization to arise, with eight-fingered, kangaroo-like bipeds developing spaceflight by about 60 million years ago. If so, and if the species had survived whatever unimaginable processes lay in the 60 million years they could have had beyond the present stage of human civilization, the solar system today might well be the playground of a bipedal society, but one to which base eight arithmetic seemed the obvious choice. Carl Sagan speculated briefly along these lines in his entertaining book *The Dragons of Eden*. But why did the dinosaurs fail to make the breakthrough to intelligence? What stopped Saurornithoides from exterminating the mammals and going on to develop their own civilization?

The best answer seems to be that a large meteorite struck the Earth just when these particular dinosaurs were making the first steps on the road to intelligence, and as a result all the large animals living on the Earth's surface died. This is the explanation for the catastrophe which brought an end to the age of the dinosaurs which is currently in vogue, and it rests upon some very good evidence.

The fact that there was a catastrophe which wiped out all large animals is clear from the geological record. Almost overnight in geological terms (which means in the space of no more than 100,000 years), half of all the land species on Earth, including all animals bigger than about 40 kilos in body mass, became extinct. Following the disaster, the world was a different place. The surviving small animals, in particular, were now free to move into the ecolo-

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gical niches previously occupied by the large dinosaurs. Most of the small animals moving into those niches were mammals—the small mammals were already well established on Earth during the age of the dinosaurs—and over 65 million years they have evolved into elephants, tigers, gazelles and so on, replacing the dinosaur equivalents now just a fossil memory. If the disaster, whatever it was, had wiped out all animals bigger than 60 kilos, then Saurornithoides would have been well placed to achieve world dominance. As it was, he just missed the boat, and in the fullness of time the little ratlike mammals which had probably been among his prey produced a new intelligent species—but one very much, in terms of superficial appearance, in the Saurornithoides mold. Of course, we have no tails and we have five fingers on each hand. But we look as much like Saurornithoides as we do the tree shrews from which we are descended. On Earthlike planets, it seems that the way to fit the niche for intelligent life is indeed to be bipedal with two arms, two hands, and a head mounted on top in the lookout position.

But it also helps to avoid large meteor impacts. The chances of winning this particular cosmic lottery are not very good, at least in our solar system.

The battered faces of the Moon, Mercury, and some of the moons of Jupiter and Saturn bear mute witness to the frequency of meteoric impacts during the history of the solar system. Even after the effects of erosion by wind and water, the surface of the Earth shows that such impacts are still hardly rare, on any geological timescale. Barringer Crater in Arizona is the classic example. More than 3900 feet across and 600 feet deep, it was produced by a meteoritic impact which can be dated, using standard geological techniques, at only 25,000 years ago. Vastly greater features, such as the West Clearwater Lake in Quebec (13 miles across) and the Vredevoort Ring in South Africa (35 miles across) show the characteristic circular shape of a meteorite impact and are almost certainly craters produced hundreds of millions of years ago. Clearly, such impacts must have dramatic environmental effects, and it is now fifteen years since Joe Enever presented the now-classic calculation of the worst kind of meteoritic disaster, published in *Analog* ("Giant Meteor Impact," March 1966).

Enever started with simple calculations of the energy involved in producing the Vredevoort Ring, using one of the simplest equations in physics—a body of mass m moving at velocity v has a kinetic energy of $\frac{1}{2}mv^2$, and if that body is brought to a halt by colliding with the Earth, all that energy is liberated as heat. A fairly ordinary meteorite might be moving at 50 km per second when it hits the Earth, and there are bits of such cosmic rubble around in the solar system with masses of thousands of tonnes. The kinetic energy released by an impact with such a body would yield the equivalent of more than 100,000 megatonnes of TNT—bigger than any nuclear device yet tested by man.

Even this, however, is not enough to explain the Vredevoort Ring, which required an impact yielding 10 million megatonnes' equivalent, coming from

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a collision with an object as big as the asteroid Hermes—32 thousand million tonnes of rock.

If such an object had struck our planet 65 million years ago, it could well explain the demise of the large dinosaurs. Dust blasted high into the stratosphere by the explosive inpact would have spread around the Earth like a shroud, blocking out sunlight, killing the plants beneath to deprive animals of food, and perhaps starting an Ice Age, or at least a mini-Ice Age, to finish off the starving survivors.

The snag with the hypothesis is that there is no crater comparable to the Vredevoort Ring but only 65 million years old to be found on Earth. But, as Enever pointed out, most of the Earth's surface is covered by water. Suppose the giant meteorite fell in the sea?

It might seem that an oceanic strike would be less spectacular than one on land, since it would be "damped" by the water. But the opposite is the case! Quite apart from incidentals such as the tidal waves produced, the almost unimagimable amount of energy released by the impact would not only vaporize the water of the sea at the point of impact, but would punch a hole scores of kilometers wide right through the thin crust of the ocean floor, exposing the hot magma beneath. Seawater pouring into the pit would eventually cool the molten rock and return conditions to normal—but not before 16,000 cubic km of water, on Enever's calculations, had been evaporated in the process.

In this version of the scenario, the Earth would be shrouded by shiny white clouds, reflecting away the Sun's heat, and the water vapor would be precipitated as snow. Once again, plants would die in profusion and animals would starve, with the biggest animals, that need most food, suffering the worst.

Everything fits. But the idea remained a speculation until 1979, when a team from the University of California at Berkeley came up with evidence that geological strata 65 million years old are enriched by traces of heavy elements, in particular iridium. The original discoveries were made in strata from Italy; since then, fresh evidence has come in from as far afield as Denmark, New Zealand, and the central North Pacific. All the evidence suggests that some global event 65 million years ago—just at the time of the death of the dinosaurs—spread a layer of dust enriched with exotic heavy metals around the world.

The best candidate for such an event is a giant meteor impact. The Earth's crust is deficient in heavy metals because any present when the Earth formed have settled into the dense, molten core. But asteroids, the cosmic rubble left over from the formation of the solar system, presumably contain a higher proportion of elements such as iridium, since they have no cores into which heavy elements can settle. The traces found in the key strata are still only traces by any normal standard, but amount to enrichment of the natural level of iridium by between 10 and 1000 times. Clearly, something happened 65 million years ago, and it would be a remarkable coincidence indeed if that something were not related to the dis-

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asters that brought an end to the era of the dinosaurs. The paleontologists, traditionally a cautious crew, have so far only acknowledged that a giant meteor impact may have contributed to the demise of the dinosaurs, perhaps being the "last straw" that came after several million years of deteriorating climatic conditions. Whatever, there seems no doubt at all that an event like the one which produced the Vredevoort Ring, if it happened tomorrow, would certainly spell the end of our civilization, if not of the entire human species (among others).

If it did, though, I'd be willing to make a small hypothetical wager that in 50 or 100 million years' time there would be a species of intelligent bipedal animals doing very nicely on Planet Earth. They might not be mammals or reptiles; they might or might not have tails. Maybe they would count in base eight or base ten, but I'd be surprised if they counted in either base six or base twelve. They'd be about two meters tall, with eyes upon heads at the top of their bodies. And they'd be speculating about the disaster that brought an end to the age of the mammals, wondering whether the upright bipeds had ever achieved true intelligence, and no doubt joking about the likelihood that those strange creatures with five-fingered hands may have used a bizarre decimal counting system. *Plus ça change; plus c'est la même chose.* ■

This article recently won a prize in the annual Griffith Observer *writing contest sponsored by Hughes Aircraft Company. The* Griffith Observer *is published monthly by Griffith Observatory, in Los Angeles.*

IN TIMES TO COME

● Last year James White had a story here ("Federation World") in which a young human named Martin "failed" an entrance exam for citizenship in a galactic federation run by a diverse collection of species—and found that he was destined for something much more interesting than citizenship. In our next issue, Martin is back, having completed his training for his new role, out on his first real assignment—which involves evaluating a new species for possible entry into the Federation. Jim White is well known for the alien beings he creates, and the Teldins are no exception. At first glance, to human eyes, their culture seemed to make very little sense, even allowing for their little problem of having to cope with heavy meteor bombardments as a daily occurrence. But most things do have a rational basis, if you trace them back far enough....

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John Gribbin

From the land of Milton, Newton, and John Lennon comes a triple threat—John Gribbin; writer, scientist, and rock music composer. Born and raised in Kent, he received a doctorate in astrophysics from Cambridge. Not stopping at the natural history of stars, he also delved into geophysics and climatology, along with the wellsprings of life and human evolution. Thus he has an overview of the entire cosmological package.

This tying together of facts resulted in the famous *Jupiter Effect*, a co-authored book associating sunspot activity, planetary lineups, and seismological catastrophes. Though rather more plausibly documented than Velikovsky's theses, Gribbin's conclusions raised a scientific uproar. John's first *Analog* appearance was a guest editorial in the March 1976 issue describing his amazement at the brouhaha. (This forum seems an appropriate spot, since he practically learned to read from back issues passed to him by his godfather.)

His first article, "New Thoughts on Space-Time," appeared in a 1969 *New Scientist*. The February 1977 *Analog* brought "Is the Sun a Normal Star?" Other books and articles on science—including his most recent book, *"Genesis: The Origins of Man and the Universe* (Delacorte Press)—were succeeded by a first science-fiction novel, the co-authored *Sixth Winter*, Ballantine 1981. Writing has been John's sole regular occupation, except for a five-year editorial association with *Nature*.

From originating as a desperate move for earnings to enable continuing as a doctoral candidate, writing has become a passion with John. Now his ambition is to have a real best-seller, even if it were just one week at the tenth spot in *Publishers Weekly*. Two more novels nearing completion will give him a try for the brass ring. As you may suppose, science still continues a major interest, especially the space effort. He feels that too few scientists present their work in an accessible form to the majority of people. His own taste in science fiction blends scientific wonder and mystery with good writing. Not surprisingly, favorite authors include Larry Niven, Jerry Pournelle, Greg Benford, and Charles Sheffield.

In 1970 John received the United States Gravity Research Foundation prize for an essay on the nature of gravity. In 1975 the British Science Writers awarded him the Glaxo National Award for Journalism. Still awaiting commercial and artistic recognition is his love of rock music composition. Tatty Records has issued a 45 rpm with a collaborative effort, "Punktuation." In this, John's own erratic typing comes to life: "As I sit 'ere writin', can't think of wot to say. The words they don't come easy . . . punktuation is all you need." ■

Jay Kay Klein's biolog

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My entry was the first blow, and hardly the last. For a moment I glimpsed cloud, islands, breakers on the turquoise sea. Then the ocean was boiling from the thrusters, and even within the secure womb of the control room I could hear the thunder of my arrival.

"Good lord, that blows it," I managed to think.

No more fantasies of slipping into the social web. No, the message was echoing across all of Kattar. Handelston has arrived. Handelston the sky-splitter, the man from the stars.

They were already waiting when I reached the shore. Every man, woman and child within running distance of the ocean. The catamarans that had met me beyond the reef peeled away, my solitary skiff scraped bottom, and I splashed into the surf to pull it ashore.

Not a sound.

I finished and straightened up.

Not a movement in the crowd packed beneath the trees. I stared across the expanse of beach at them, and they stared back. Perhaps they sensed in my skinny-soft carcass the genes of our mutual ancestors. More likely they saw the differences. My ship, my clothes; how could they bridge that gulf when they no longer remembered even the seed ship that had brought them here?

The academy had not prepared me for this. My throat went dry. These people had known I was coming, of course; first contact had been made, of course. But this?

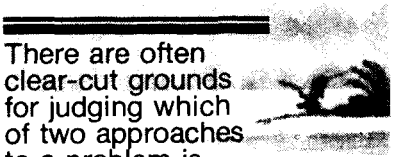
I raised my hand. I coughed.

And with a roar of joy, the tide was upon me! Snatched up on a hundred eager hands, I thundered into the city.

Such was the day of my entry, swept in procession through the streets of the city that gave the island its name. If I even once wondered why I deserved it, the thought was lost in the roar. I deserved it because I was I, and what that meant hardly mattered. I was toasted, I was cheered. I shook a thousand impressionable hands.

And a single pair that was not.

For a moment the crowd left a pool around us. I had not seen his expression,



There are often clear-cut grounds for judging which of two approaches to a problem is superior—on purely technical grounds. When human beings and cultures must also be considered, the matter becomes a good deal more complicated.

David Lewis

KARNEV'S WORLD

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had only reached again into the smear of fingers and yellow teeth. But my hand went over his like water, and I found myself looking not down but level into a thin face, skin stretched on bone without delicacy, but with the resilience of age tempered into power. His eyes burned into mine, and as my head reeled in the heat and crowd, I suddenly felt farther from myself than I had ever been before.

Our hands separated, and the praise heaped upon my interstellar self echoed hollow under Kattar's riotous night sky. Find yourself, my advisers had laughed. This is a test.

And you're the rat.

I saw him again later that evening. The master craftsmen of the island were introduced. All surged forward to test my clothing, my dark skin and high nose. But he alone remained aloof. Watching me briefly through the swarm, he turned and left, a studied gesture, his white sarong fading into shadow. Vekkar, head of the council, followed my gaze.

"Karnev," he said smugly, as though he, too, were privy to secrets I didn't know I had. "Midwife to ships. That man is old."

Vekkar, presiding over two hundred low, dun buildings baking in a coastal-plain sun, was himself a sandy dun as he guided me down another convoluted street. He was overfed and gaily decked, topped by a hat that towered above my head. His scantily clad cronies, the rest of a forming bureaucracy, paraded noisily behind us.

They weren't what the academy had taught me about politics, but that was why I was here. To learn the limits of what an academy could teach, and what it should teach. It was my first field test.

Shaking free of the city, we walked steadily north along the coast. Far out, the upside-down triangles of catamaran sails marked the fishing grounds; on our left, irregular paddies, iridescent with new shoots, subdivided the flatlands that lay between us and the volcanic eastern hills.

The equatorial sun was heavy. We rested in the frequent shade, and came finally to a small, tree-covered peninsula lying flat beneath a curl of smoke. Our trail plunged into pungent woods, and we reemerged before Karnev's home.

He was waiting for us, alerted by the scattering birds.

"Hello, friend," said Vekkar.

"Hello, friend." he replied curtly. He did not acknowledge Vekkar's camp followers. Nor did he acknowledge me. The long white cloth was gone, and in its place he wore a dark leather apron. His belt hung with tools.

"I am working, council head. Why have I been disturbed by you?"

Honorific speech doesn't have to sound unfriendly. Vekkar bristled.

"Handelaston has wished to be met by you," he snapped.

"By what right have I been disturbed for him?"

"By the same right that you may be disturbed by me."

"By the same right!"

Karnev raised his fierce eyebrows. Long squatting had bowed his legs, but he was not awkward. He came up close and looked at me, starting with my face and working down to my hands. His

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expression didn't change.

"What have you done?" he said in the impersonal.

He was staring full into my face, a thing equals did not do here. But I did not turn away as I should have: instead, I levelly returned his gaze as though it had told me nothing.

He fell back a step, and we regarded each other more warily. He felt as keenly as I that a cultural cue had been misread. Face to face, our worlds were not in contact, and with them, our values.

Vekkar, however, was firmly in Kattar. Karnev's insult was deliberate, and could not be ignored.

"This man has been brought from the stars!" he exclaimed in full honorific. "By that right have you been disturbed."

Karnev looked at him sharply.

"What is it to have been brought from the stars?"

"As you are the only building of ships, as I am the only council head, so Handelaston alone has been brought from the stars. That is what it is to be brought from the stars."

"Where he is from, perhaps everyone is brought from the stars."

Vekkar could not grasp that. "He is to be the only one!" he reiterated furiously. Karnev shrugged. Our exchange of looks had puzzled him, so he moved to securer ground.

"He is the guest of the council head. As that man's guest he will be met by me."

Vekkar breathed out angrily, but was plainly relieved. And I nodded sagely to myself, filled with the conceit of partial understanding.

In the three weeks I had spent on Kattar my transcriber had filled with notes on my new home's body politic. It was unlike anything the academy had taught me.

In Karnev's world there are two reputational ladders, absolute power and skill. Between these two the power predominates and the Vekkars reign supreme, but next to this stands skill. The greatest artist, the one who most approaches the perfect in his craft, is the social equal of the strongest in the land.

This makes for a system full of tensions. The artisan and the politicos eye each other's throats. But it is far harder on the individual, who must somehow seek a definition of self.

On Kattar it is only the greatest skill that is rewarded. Anything less brings little or nothing. To be accepted, one must achieve perfection. To fail—as all but one must do in every craft—means at best a meager return on life's investment, and at worst a tragic loss of self-esteem. Suicide is not unknown among the artists of Kattar.

If so, one might think it better not to try than to pay the price of losing. But argue that out with those who covetously watch the winners. Even Vekkar's prestige paled beside that of the master craftsmen, and how much more beside that one unquestioned master: he who made the most priceless artifacts of a society bound by the sea.

Karnev was the midwife of ships; once one had sailed a Karnev hull one could not be content in another. He had an intrinsic skill with his adze; devoid of theory, he sensed all things in their totality of context; his hands in movement on his hull models flowed like

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water over every grain. The completed ships that I saw—huge traders, their double hulls able to reach the distant continent—showed no flaws in the exquisite sweep of their lines. They were hulls that could swim with porpoises; his hands had told him so.

Following that meeting I was allowed to watch Karnev work, but only by his grace. All others, from village matron to atoll shaman, grovelled in my presence. The water-rinsed bobbing of my ship off their island was the eternal knell of their pride, reminder that they could neither fly nor split the star fields with thunder, that no matter how alike our hair and eyes might be they could never equal my awesome power. It was Karnev alone who saw that I was likewise weak when set among my peers. Our contexts exchanged, he knew my inferiority, for in his art he worked in the totality of contexts and understood their subtle flow. His haughtiness was honest and true, and for that I should have been grateful.

In the rashness of my earliest field days, I was not.

We sat in the sun one morning toward the tail-end of summer, Karnev's latest hull looming large beyond us. My transcriber, active mode light winking, hummed annoyingly on my belt.

"How are the ships beyond the sky?" Karnev asked, his resting fingers drawing circles in the sand.

"You've seen my own," I started, but he cut me off with a curt jerk of the head.

"That is a sky ship. The ships of the sea. You are a man; where there are men there are seas."

"There are not always seas," I started, but thought the better of it. "There are many kinds of ships," I said instead. "Of the ones I know, most are made of metal and don't have sails. They are huge, some of them hundreds of meters long."

He continued to draw circles.

"That is nonsense," he said.

I glanced at him, annoyed. How many times had Karnev responded that way?

"No, that's my world," I said heatedly. "There are people who have never seen ships made of wood."

"And how do you shape these metal ships? And how do you move them without sails? How can any man make a ship hundreds of meters long? And how do you put it in the ocean then?"

I was uncomfortable.

"Mostly we use machines."

"Machines! Always you say machines! Perhaps you think the world is a machine. Little man from the sky, I have seen the machine you came in. I do not know how it is made. But anything made like that is not a ship. This," he rose to his feet, a brown walnut of a man, and stamped over to the hull, "this is a ship. This is what ship means. A ship is not a machine. A ship is the blood of a man. And you, where you come from there is no ship, only machine. And where there is no ship there is no man. Just as you are no man."

He turned his back on me and looked at the sea. The smell of fresh-cut lumber stung my nose. I felt something inside giving way, beginning to splinter.

"You're blind!" I shot back at him. "There are other ways than the ones you know. Don't show off your ignorance!"

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"Ignorance, you say! I am Karnev, little man! Who are you? I am the builder of ships, little man. What are you? Ignorance! You are the one with ignorance! You are nothing. To me, to the sun, to the sea, nothing! I spit on your ignorance, little man! Get away so I can breathe!"

The sun pinned us down as we slashed each other with our eyes. I was not any kind of weakling. I was trained in prestigious schools on worlds where Karnev's equals stood beyond number. Perhaps I hadn't yet achieved, but I was en route. Someday I would speak for whole planets, sit on councils that set the fates of millions. But to Karnev I was nobody, not even the smallest seed of a man until I burst upon the stage full-blown.

At least that was how I saw it then, and so seeing it, how could I not resent that scorn? Get away so he could breathe! The beach was rank with his pride.

"Ships!" I cried. "Is that all your world? Then I'll make you a ship. I'll cut a ship that will make this," I grabbed the model that guided his labors, "make this toy a stone! If it's ships you want, I'll show you a ship from the stars. Toy-carver, you'll see what I really am!"

There was a silence between us thicker than the curve of missing sunlight beneath the half-finished hull. The ocean was infinitely far away. Karnev waded toward me through the terrible silence. He pulled the hull model from my hands.

"You bring me that ship!" he hissed.

When Vekkar heard what I had done he was more than a little amused. I had not shown the ability to make a scow, much less challenge the skill of Karnev. Yet it was still a serious matter that could possibly work in his favor, and he made it clear that the news would spread and the affair not rest until I had matched my words with deeds. So warned, I resolved to act as fast as possible.

The day after the confrontation I went down to the harbor and raised my skiff's sail in the early morning sun. Against the lattice-braced sheets of the fishermen my cat-rig was carved in a single sweep of white. Waves spilled over the splashboard until I escaped the beach, then gurgled placidly by as I beat toward the bright silver ball that had brought me here, and someday would take me home.

If I lost this strange contest, I mused while the ropes tugged in my hands, where would I stand for the rest of my year on Kattar? I had entered into this rashly, but now it was growing about me, making connections with all I had come to face in this new world.

If I could not find my own place on so simple a plane as this, if I could not come to terms with who I was to be in so unencumbered a society as Kattar's, how could I ever hope to handle myself in the infinite complexities of our far-flung confederation? How could I pass judgments affecting entire planets if I had yet to find the courage to judge myself?

I say I mused on this, but I am too gentle on myself. As I closed on the curving hull of my ship I still phrased the problem in terms of pride. I would force Karnev to respect me, I told my-

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self. I would make him see me for what I really was.

How could I know that what I had to fear was not defeat, but victory?

Slipping into the lee of my ship, I dropped sail and sculled along to the airlock. A shrill wind charged from the hollow sky, churning froth against curved metal. I hesitated, my mind caught by the shifting gap between entrance and gunwale. Then I leapt across. The skiff porpoised, caught the wind, and slammed back against the metal sheer.

The horizon swung in and out of the hatch opening, a scarcely visible mesh of blue on blue. Without even noticing it, I entered the darkness of home.

After so many weeks away my ship hung tenuously between the familiar and the unknown. Banks of colored dials glared at me; plastic molars grinned beneath flat green displays. It took me minutes to find my old place, to connect my sunburned self with the *I* whose head had fit the flight helmet gleaming dully on its rack, whose body had swung in fusion with the stars. Uncomfortably aware of an ill-matched seam, I settled myself before the terminal.

My fingers slid onto the keys and there was no separation. The junction between plastic and flesh was lost, the ship seemed to course through my veins, I was the ship, she was I, as I tapped the mind of my preserver and she in turn took purpose from me.

INPUT

My fingers rolled in continuous motion

DESIGN PROBLEM

there being no break from the thoughts of my mind

OPTIMAL SHIP HULL DESIGN

WITHIN FOLLOWING PARAMETERS

and the flow of neural, muscular, electrical reactions into her centers.

All things considered and none omitted. Water density, the height of the waves. Water flow at different speeds. Slowly the ship responded to my requests, lines snapping into life on panels far removed from the keyboard, sudden staccato chatter slicing into breathing and blowers, and beneath it all, felt only in the soles of my feet and the light, inconsequential flowing of the inner ear, the heaving of the ship herself, riding the eternal surge of the sea.

The program ran its course, crescendoed, subsided. The control room fell silent. For a moment I held my breath, burrowed below the slow roar of the fans, and felt again that colossal movement of the ocean. Then I shook my head and walked to the machine shop.

There I again pressed fingers against a keyboard.

MANUFACTURE

The shop hummed into action and I left it to its own devices. I went back to the hatch and checked my boat. It was still there, of course, the shifting gap between its gunwale and the damp curve of the ship seemingly uncrossable.

But I had crossed it, for better or worse.

I squatted in the entrance, unconsciously using the native style, and watched the horizon swing brilliantly blue. The sun flecked whitecaps to the brink of existence. Beneath me my ship unerringly executed its hull. I thought of it, and saw in my mind the carved mahogany block of Karnev, immobile

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beyond the infinitely tender caresses of his knife, shaving wood so fine the wind caught it and blew it across the compound.

For a moment I was shamed. What did I think I was doing? Who or what was I, in my metal ball on the sea?

I say I felt this, but it was only for the briefest moment. Mostly I watched the dip and sway of the horizon and did not ponder, as the sun traces its ecliptic without pondering the advisability of going west to east, or north to south. To that degree I had entered Karnev's world.

Two hours later I beached my skiff with the help of playing children and made my way home. The near-shore fishers were coming in, their thin, tan sails like leaves on the sea. I had just entered my room and put down my shrouded hull model when Vekkar and his procession swept in upon me.

"Handelaston," he proclaimed, "you are ready to challenge Karnev."

"That's right," I agreed helplessly. "How did you know?"

"The fishermen said you went out to your ship. The children say you return. We will go now. There is no time for waiting."

I rose, more than a little annoyed, and picked up my bundle. Twelve sets of eyes followed my movements.

"Handelaston," hissed Vekkar eagerly, "will you show me your hull?"

I looked at him, weighing the object in my hands.

"No," I decided. "Karnev should see it first."

We paraded out of the city and into the countryside. Farmers gaped from their wet-fields, for our procession was hardly subdued. I felt like a mountebank leading my troupe. The younger men scattered up and down the path like chickens, whooping and joking. Even Vekkar cut some unseemly prances. I could not rationalize the gaiety in what seemed to me so utterly solemn a vendetta. Now I think they thought it a joke. The preposterous challenge could not be taken seriously.

Karnev was waiting for us, and he saw nothing humorous at all. He stood in the shadows of the house clearing, wearing the long, white, sarong-like cloth he had worn the first time I saw him, and under his arm was a hull model, gleaming with oil.

"Hello, shipbuilder," Vekkar said.

"Hello, council head," Karnev snorted.

We filed into the house for a brief ceremonial meal. The tension was almost audible. Then Vekkar got heavily to his feet. In seconds he had invested himself with authority, a tremendous gravity that should not have existed in the man I had come to know.

"Karnev, builder of ships, by Handelaston, man brought from the stars, you have been challenged in the building of ships. Has this challenge been accepted by you?"

Karnev squared his bony shoulders, and held the model out before him. We could barely see it in the feeble light.

"By this I answer," he said.

Vekkar looked at me. Not sure what to do, I held out my own bundle of cloth. "By this I reaffirm," I said.

Vekkar puffed out his cheeks. I had probably spoken too soon, but I was foreign and could not be helped.

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"We will be brought to the outside," he said gravely, "where in the light these ships may be judged."

Ponderously, he ducked through the doorway opposite the one we had entered and paced down the courtyard. We all followed, Karnev in stiff dignity, myself a little too fast, unsure of what was going on, the crowd of young men almost sheepishly, though still amused.

In the courtyard we formed a circle, with Karnev and I facing each other across the axis. Vekkar adjusted his hat, stuck out his lower lip, and dropped his voice.

"The ships must now be shown," he intoned.

Karnev stepped into the center of the circle. Again he took the hull and held it out, but this time we could see.

The wood was almost red. It had been polished and waxed so smoothly it reflected light. It was like the point of an arrow, the tip of a spear enlarged; it flowed like water from stem to stern. It would have been impossible to build with the technology at hand, but it could be carved, and if it could have been built it would have been the finest hull to cut the waters of the whole vast ocean. It was the extrapolation of ship to the ultimate meaning, the symbol of Karnev's life.

I only noted that it was not a practical design, and the practicality of my own would not be questioned.

But what the others noticed was the glittering hull itself. The out-take of breath was the mark of their respect. They stood in awe.

It took a moment for Vekkar to get over that model, the like of which he had never seen before. Then he shook his head. And looked at me.

"Handelaston," he started.

I had anticipated him. I got to my feet and stepped into the circle, still keeping the cloth over my creation. Cloth and all I held it out before them as Karnev had done, then let the covering fall. I said nothing.

For a moment, neither did anyone else, as they stared aghast.

The hull I held before them was plastic white, and whatever else it was, it was not beautiful. There are no words in the nautical lexicon to describe this ship of the stars. There was not an unbroken line upon it; the bow was wider than the stern, and the beam narrower than both. It was a bulbous string, a pea pod with the peas inside. Complex curves wiggled impossibly along its sheer line; sunlight gleamed from a dozen highlights. I held it out in front of me, wondering what effect this could have upon my audience, and above all, on Karnev.

The choked silence finally broke—in laughter!

They had thought it was a joke, had been unable to stifle the giggles and felt nervously guilty, and now, by god, it was a joke! The young men could not stay in their circle; they pushed forward, would have grabbed the hull from me had I let them. They whooped and whistled as though the world turned on a merry-go-round. Vekkar subsided into the sand, hiccupping.

Karnev shoved up to me, his eyes furies.

"You mock me, little man!" he raged. "I should break you!"

I looked back at him as coldly as I could.

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"They are mocking," I told him. "I am not."

We glared into one another in silence, and he saw that I was not. His hands wrapped around my hull.

"This is your ship?"

"This is my ship."

"Then you have lost!"

"I think not. They haven't been tested."

His hand swung to take in the riot.

"Judgment has been passed. They think you're mad. You have lost."

"What is their laughter to me?"

"It shames you. You have lost."

"It doesn't shame me. Karnev, builder of ships, doesn't laugh."

"I, too, laugh," he said.

He threw back his head to laugh, but he could not. His hand still clutched the hull, his fingers slid on its curves, he could not let go. Perhaps those fingers were trying to speak, to tell him of pressure zones, dynamic forces, wasp-waist fighters and hydrodynamics, a thousand factors he could never know but his fingers—superlative, strong fingers—could feel. He did not laugh. He looked into my eyes, and could not laugh. His other hand tightened on his own hull, the masterpiece of his life.

"You do not laugh either," he said.

The young men cavorted around us, but I glanced up and saw that Vekkar was staring at the way we glared at one another. He came over, brushing sand from his clothes.

"I guess maybe we'd better be going."

"No."

It was Karnev, his voice brittle.

"What is this?"

"We still have to test."

Vekkar was astonished.

"Test? No need for testing! This is absurd! A silly joke. Handelaston should apologize, but test this, this thing?"

Karnev was almost shaking.

"Blind, blind man!" he hissed. "This is absurd, but this is a ship. An absurd ship. But a ship! I do not trust it! We must test."

Something in my stomach suddenly snapped. An absurd ship, but a ship! He had seen; for a moment Karnev had broken his culture and seen beyond to another world he could not imagine and seen there—a ship. An approach so strange he could scarcely believe, but must accept. A validity he could not deny, though he could only half-comprehend. And it seemed that for the first time I, too, could see. I could see that this should not go on. I had made my point; I would never need to make another, not here, not at the academy, nowhere in the salt-pepper stars of the galaxy. There was no need for making points. No man could justify making points! And now it was moments too late.

"Shipbuilder," I broke in quickly, "I concede. You win. We don't need to test these hulls."

He looked at me and smiled slowly, finding his way to familiar ground.

"You are scared, little man?"

How could I tell him that I was scared now—scared, now that my anger was gone, of what the ship from the stars could do? Vekkar's friends drew closer, far too many.

"Then a private test first," I urged. "Between just you and me."

Karnev looked at me and his eyes

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narrowed. The preposterous hull with its curves and valleys fit his right palm like a compound bow, his own finest settled like a javelin in his left. He was sinking back into his own world; pegging me a coward flung him further into it. There could be no comparing the two hulls, one speed epitomized, the other a mocking hodgepodge. His logic told him this was so, but he did not trust me. I was an unknown. I had split the star fields on coming; my ship had boiled the sea. But I was also an impudent puppy.

His hands tensed and released on the waxen grain of the hulls. To scourge me in public or not . . . Poised on the brink of different realities, he had a choice no man of Kattar had ever known, to strike out on a different ocean with no strength but his own, no knowledge beyond the quickness of his mind. His instincts would be far behind him. But this last, I think, he did not know.

His eyes snapped from weighing to scorn; he windmilled his arms and thrust both hulls at the sky.

"We will test them as we have always done," he proclaimed, a macabre mix of defiance and pride. "Now, in the basin, as we have always done."

He glared at everyone once, then dropped his arms and left the courtyard. Amid a fluster of murmurs, we followed him *en masse*.

The testing pond lay some fifty yards beyond the house, close by the sea. It was long and clear, stabilized in the sand with a buttressing of logs. Karnev, or more likely his father, or father's father before him, had made the pond from the former stream, not by reconfiguring, but by slightly redirecting an already extant push of the world. The surf roared beyond the sand bar, but on the water of the pond only aimless, erratic wind-scratches scurried into stillness.

Karnev did not stop to admire the view. Both hulls clasped to his side, he stalked to the ocean-channel end of the basin. He dropped down abruptly, and began to fit his own hull into what appeared to be a launching chute. The others squatted along the log siding. One of the irreverent, a young man sporting two extravagant feathers in his hair, paddled his feet in the water.

I went down to look at Karnev's handiwork. He glanced up darkly before continuing, a haughty excess of movement replacing his former economy.

The chute was a water-filled slipway and release designed to hold and launch a model ship. The first hull, oiled red-brown, floated motionless within. Karnev rose; the jokester jerked his feet from the water. Last ripples spread out to the other side, stopping there as though swallowed.

Karnev looked straight into my face, and the pride this time was not overacted. His lips, rough and blackened, barely moved.

"This is my hull, Handelston," he said, and released the weights.

They fell; the launch board splashed. For a moment that seemed all, and then the hull was springing out across the thin, transparent surface. It fish-tailed for a moment, shaking off the direct impact of the launch, then arrowed straight and true, leaving bars of thick translucency in place of a wake. There

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was no sound but the muffled thunder of the surf, no sensation but that pristine motion against which the world seemed still.

When it was plainly moving no more, beginning to drift, Vekkar's friends burst into a clamor of applause and trilled whistles, while the boy with the feathers ran down to mark exactly where the hull had stopped. He jabbed one long plume into the sand directly abreast of the exquisite carving, and whooped. Everyone there was immensely pleased.

Karnev squatted again to launch my hull. I did not tell him it was mine, for I realized now it was not. It was my ship's, and through her, the future I could not explain with words. He set it in place as meticulously as he had his own, but it lacked the intensity of ownership. I could not blame him. I should have done it myself.

I watched the bulbous improbable shape glide out above the ridges and corrugated valleys of the testing basin floor. I felt only a certain tight satisfaction. Even at the moment the launch board hit her, she did not pitch. And as she progressed, for she did not seem to move so much as to change position relative to the shore through some mechanism not quite explained by physics, as though she herself hung motionless while the world moved regretfully past, there was no wake at all, and only the slightest roiling of water at her stern.

Out and out she glided, as though inertia held all meaning, as though the Pleistocene had sent her skimming time, instead of water, eternally in flight the slight ripples on softer than parting whispers. The silence about her grew deeper. Karnev's molten hull fell behind the other-worldly brightness; the feather marker tugged in a scurry of wind that passed over the machine-carved curves and made not a jog in their dead-arrow course until at last she stopped, last momentum evaporating into the crystal water, and remained as motionless as when she had moved, not even drifting, only rocking slightly when caressed by the shifting breeze.

Karnev's hull swung closer to shore, a full three meters behind. Two Feathers approached the preternatural victor as though it might turn and lunge upon him, jerked in his second feather, and jerked away. He let fall a feeble whoop. Vekkar looked at the two floating sculptures and rose to his feet.

"Handelaston," he said, "that is a hull. That is the hull."

He came over, his headdress bobbing above me, his face looking up from below.

"Now we go to eat," he said. "You come too."

He started down the trail. Two Feathers, emboldened, ran back, seized first his first feather, then, seizing the second, gave a full-blooded yell. The surf roared. Wind tracks dashed across the pond.

Karnev squatted, his face frozen, staring out at his hull and the surreal intruder beyond. I stirred uncomfortably.

"I guess maybe we'd better be going," I said.

Karnev looked up with his frozen face, and said nothing.

There was no shaking of the foundations of the earth. The sky did not

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crumple into the sea. Only I found myself more exalted than before, and where men gathered to speak of ships the name of Karnev disappeared. So utterly, it seemed, he had never borne a name.

The ceremonial meal of the breaking of castes was so casual as to bear no mentioning. There was so little clamor that I wondered if they had accounted for my victory by my extraterrestrial birth, and applied no significance to the contest.

But that was an illusion quickly dispelled. The very next morning Vekkar's band arrived to move me to a new house. I protested that it wasn't necessary; when that failed, that I only needed a small one, with none of the extravagance they spoke of so easily.

"It is more fitting, Handelaston," Vekkar argued.

"Karnev's house was nothing," I argued back.

"What that man does is no concern. You are Handelaston, shipbuilder brought from the stars. What is this man Karnev?"

"All right, all right, I like to live in small houses. Isn't that my right?"

Vekkar shrugged helplessly and left, muttering under his breath.

I was abruptly surrounded by honorific speech and felt as I had when I first arrived, missing half the words. An old woman appeared to cook my meals; I confess I let her stay. It took me days to learn that this very status that imposed so many rules upon me also gave me the right to break them. It was, all told, a priceless experience, and one scarcely to be endured.

Several weeks later my nerve returned, and I prepared to reenter the countryside.

"I'm going to see Karnev," I told Vekkar. He was aghast.

"That man's not good enough, Handelaston. He has no right to see you."

"I have a right to see him," I returned smugly. "I'm going."

"I say it's bad, Handelaston." He slapped his palms and sat heavily. "It's bad."

Herds of cloud were gathering over the eastern hills when I left. The farmers were draining their wet-fields. Fish flopped and shuddered in the mud as children ran among them, shouting and hurling clods. I walked on.

Karnev's life had not come to a halt, no more than any bested craftsman's did; only the prestige had drained out of it. There was always a need for baskets, for pots, for ships. And this time, more than usual, his life proceeded as before, for this time, more than usual, he was needed. I would never build my winning hull.

But those other things of riding the crest, of mastering the curlers of the world and riding their thundering assault on the social sand, these things had gone. His visitors now were perfunctory business-talkers. The narrow path through the trees drew tighter, and even the birds seemed silent.

Karnev was standing in the door when I arrived.

"Hello, friend," I said. He did not hesitate, though his posture rebelled.

"Hello, master."

He turned and entered the house. I followed, back into the room where we all had gathered some three weeks before. We sat opposite one another across

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the hearth fire while he prepared a token meal. He looked away while I ate it, and only turned to face me after I had pushed the plate aside.

"For what purpose have I been met by you?" he said finally.

"Enough is enough. Let's use informal."

"Informal speaking is not to be right."

"I can't understand honorific!"

"That is so."

The fire spat, and a puff of sparks floated upward.

"Then why have you come? To step on a small man?"

"What rubbish is that? I don't step on small men when there aren't any to step on."

"There is," his fingers walked delicately on the floor, "one small man and one big man. When there are two men, one is always small, the other always big."

"In my home there can be two big men, or two small."

"You are no longer in your home, shipbuilder. You are in Kattar."

"I'm still myself!"

He looked at me across the fire. His face was hollowed by the flames.

"You cannot be yourself in Kattar. This at least you should know."

Our minds seemed to brush. The fire held us apart, and drew us close together.

"Is Karnev himself in Kattar?"

"Karnev will never be himself. He was not himself, and now even that is gone. Who are you, Handelston, who comes from the stars?"

I could not answer.

"Who is Karnev?" I asked back.

"There is no Karnev. He went away."

"I see Karnev before me now. Who is he?"

"You do not see Karnev; Karnev is gone. Karnev was the builder of ships."

I rocked back on my heels.

"You are still a builder of ships."

"No, I make ships."

"Then you are the builder. No one builds better ships than you."

"No!" Our minds fell away, and I looked into his furious face, broken apart by the flames. "You step on me, big man! I am nothing; you are the shipbuilder, you are the sky-splitter, you are Handelston, the builder of ships!"

"You don't believe that!"

"I must believe that! It was your hull. It was your design. That hull that was the finest I ever made, that went the farthest of any I ever made, even that did not go as far! I would not believe if there was no reason. Do we see what we do not wish to see until we are made to see it?"

Looking down the court between the long, U-shaped extension of the house, I could see no other sign of life. Those rooms that in most other dwellings resounded to the turmoil of an extended family, the ranting of siblings, the rolling sea of children and their half-domesticated pets, were boarded shut. Only the base of the U where we sat remained alive, and only then by the eccentric fires of the artist. When he was gone not even an apprentice would take his place, and the straw mud walls would embrace one another in the hearthside hollow where we sat.

"That's not my hull," I told him at last. "I did so little to make it I can't call it my hull."

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"That is how all ships are made. The power is not our own. It acts through us, for that power has no hands. It does not care for us, and when it leaves it leaves us with no care. My hands made my hull but I did not. We were both tools of that power."

"That's not what I meant. Machines made my hull. I didn't even touch it."

"The power comes in different ways. Perhaps it was ready to make a hull. Perhaps it was a hull that needed machines. It used you to make itself; it has used me to make itself. Watch your head doesn't grow too heavy, for the power will seek another way, and you and your machines will be idled. The power will discard you. The power will not care."

He stirred, almost uneasily.

"I should not talk to you this way." His mouth grimaced in the dark. "I am old, and I have been discarded."

Something small walked slowly across a roof beam, its feet scraping on the wood. My hackles rose against the dark. Karnev, the midwife of ships, was gone. A shadow served me his best food. A shadow built ships to no more purpose than the rankest beginner.

I got up.

"I guess maybe I'd better be going," I said.

"I am sorry I have offended you," he mouthed, the new words distasteful. He hesitated.

"Shipbuilder," he said, "you have left your hull."

"I guess I have." I had left it the day of the competition, and never asked for it back.

"Shipbuilder, may I keep your hull?"

I was surprised, and in my surprise inexcusably rude.

"Why?"

"To respect it."

"Respect it! What do you mean?"

"It is the finest hull there is. I wish to honor it. I wish to become your student."

At first I thought he was mocking me. I felt so guilty this made me mad. But there was no mocking. There was a sincere humility that made me nauseous. I had to get away from this farce, this perversion.

"Keep it," I told him, holding my voice level. "It's not mine; I never touched it. It's yours so long as I never see it again."

I stopped in the door and looked back dramatically.

"It makes me sick," I told him, and left.

I did not see Karnev again that summer. I did not see him through the fall. The clouds changed, the winds shifted. I rode the tradeships to the continent. I learned to fish, to bend my back to nets of silver. I did not see Karnev, and the seas rose. The season of storms was upon the islands, and I huddled with the men in the low ceremonial halls as rain drummed across the conical roofs. My ship was an occasional glimmer seen from the summits of the eastern hills, rising and falling with the uncrossable waves.

There is, toward the end of this endless season, a major ceremonial on every island of the archipelago, held in the central village and lasting for a week. It is here that the status rankings are determined, and governmental duties assigned. It is here, on the brink of the return to the season of labor, that

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the loose strings of island society are tied up once again and the house is set in order for another year.

I had finally come to rest in a village on the east coast, accommodated beyond reason by virtue of my reputation, and insulated from the events that had earned it for me. But when I joined the pilgrimage to the yearly fest I had hoped, indeed, expectation of meeting Karnev there. Perhaps the galling event that had sent me away would have found adequate rationalization, and things could return to normal, both for him and those corners of society that my misconceived experiment had touched. I hoped that this was so, for I am, despite all evidence, a lady man, and even then that emotion stirred within me, even in the reckless, undisciplined days of my first field study, I wished to put things back the way they had been before I came. But rising over all other thoughts was the knowledge that now, with the imminent unfolding of the calendar year 3840, it was time for me to go.

I had not seen the city for months, and on my return every corner, every color, every shape and shadow etched itself across my eyes with the clarity of a life soon lost forever. But such a parting! For the city had worked while I was there, had heaved and sweated in the sun, and now the city played.

Every street was a monstrous booth, the restless rain swirling a river through it riddled with wrappings and rinds. Children dammed Amazons with their feet and glittered in dashing sweeps of sun. Voices rose and knit themselves above our heads, insistent as the coasters, and breaking the dull, concussive roar were the shrills of reeds and the shaking twang of loose-strung instruments. The artisan shops had burst onto the streets, displaying their most dazzling goods. With all the island gathered into the rain-filled alleys, the chance for mobility, for the rise and fall of reputations, had come for once a year.

I pushed through the thronged streets to the house Vekkar had seen built for me. It had been dead and empty these many months, but now I reopened the doors and worked to bring it to life. People poured by, poured in and out. Familiar speech held sway as the norms were washed away in the rain of the storms, and all stood equal on the verge of the new year.

"Handelaston," Vekkar swayed in, wearing the plain white clothes that all had on, "you return. The villages didn't take your fancy?"

"The villages are fine," I told him. "But I started here and I'll leave from here."

"You'll leave us soon, Handelaston, going back to your sky?"

"I'll leave you soon. It's been good, but it isn't my life."

"Then," he ran a finger across his forehead, "this is the time to leave, when things are healed. When the rain makes us clean again. Then you will remember only clean things, when you go back to your sky."

Our eyes moved uneasily past a meeting. "Vekkar?"

He hesitated, halfway out the door.

"Has Karnev come to Kattar?"

He tilted his head and shifted his weight.

"Saa," he said. "That man still hasn't come."

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The week of the festival swept around us, and each day one could feel the society pulling slow together. One day the politicos reappeared; another, the young men received their initiations; slowly the social glue, the glue dissolved on that first wild day so completely one could scarcely remember what forms it held, was reset in orders and ranks. Each day sobriety returned, inching painful progress against our desperate gaiety. And still Karnev didn't come.

Talk, freed of restriction, circled around his absence. One had no business ignoring the rain. The society survived on the blessing of the rain, and breathed in the break of its discontinuity. It was a time he should not ignore.

I tried to put his absence from my mind. I sailed my skiff through breaks in the weather, beginning to load my ship. I changed the house decorations, drank with Vekkar, reaffirmed my ties with a thousand faces beneath the clouds. And walked, often, with a desperate hunger for all the things around me, up and down the streets and through the fields that had come to be my home.

He came out of the rain on the festival's final morning, as the clouds shivered in the western sky and curtains of sunlight misted across the horizon. He carried a bundle, two, each thickly and carefully wrapped.

"Hello, friend," he said as he entered.

"Hello, friend," I said in reply.

We sat opposite one another across the hearth fire, and watched the flames worm out along the wood. He seemed much older; perhaps I had merely forgotten. But his back was stiff and his face proud.

"I have come to challenge you," he told me.

"I've been waiting. Shall I call Vekkar?"

"Vekkar knows. He will be waiting."

"Then we'd better go."

We walked quickly along the northbound path. The wet-fields stretched grey and empty toward the shore; rain speckled their dull sheen.

On the hard, watered sand by the testing basin Vekkar stood motionless. His hat towered above him, his ceremonial clothes hung damp. The greyness invested his stature with a tremendous dignity, the age of his culture, here at the edge of the sea.

We unwrapped the hulls. Mine lay in its cloth cradle, cold, clinical, and effortlessly smooth. I had to smile at it. I picked it up and stroked it, and felt my fingers tingle along its curves. I palmed it, and it fit there like the stock of a compound bow. I found an immense nostalgia within me. Then I handed it to Karnev.

"Launch it," I said.

Out, out she flew, effortlessly over the soft sand ridges of the basin floor. She was suspended on the crystal water, not seeming to move so much as to change position relative to the shore through some mechanism not quite explained by physics, as though she hung motionless and the world moved regretfully past her; there was no wake at all, and only the slightest oiling of the water at her stern. That and the minute, concentric circles of the rain.

At last she stopped, frozen above the water. The surf crashed ceaselessly beyond the bar, and pushed foam fingers

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up the channel from the shore. Karnev unwrapped his hull.

And held it, fitting his hand like the stock of a compound bow.

It was the sister of mine, the bright sun of my moon. It was carved in the red wood of the islands and glowed warmly with weeks of love and labor, wax and oil. Its impossible curves, wasp waist and bulges, the sagging sheer, rested within the net of grain and flowed more smoothly through the heartwood than words can tell. I knew without asking that his eyes had been closed when carving, that only his fingers had flowed with the sharpened blade in the dips and whorls of hydrodynamic flow, that no sight had turned this shape but the eternal imprint of the white intruder, silent and lonely in the testing pool. Karnev knelt down, set the hull tenderly in the chute, and dropped the weights.

She was motion in essence, extracted from all the motions of the world. Beside her even the march of time stood still, the waves' dark roar stretched out and out into silence, the sand blew on the wind single grain by grain by single grain, and all was still. The sea birds were painted against the sky; we could not breathe. The oiling was gone at her stern; she was inertia, the sweep of the star on the galactic circumference, impossible and grand. She flowed past my hull, the water itself in movement, the current of life made manifest in wood. On and on, slower and slower, until so slow we didn't realize she had stopped, and only some minutes after found we could rise and talk. I stood back as Karnev walked toward his child, legs slightly bowed, feet almost shuffling, yet flying high, so high neither I nor Vekkar nor any other man on all the islands could mark his flight. He knelt on the bank abreast of his hull and stretched out his hand toward it, and stayed there, his fingers not quite reaching, returned to life. Vekkar approached him, regally, solemnly, to announce that he had won, and I, bested and finally knowing it, gathered my cloth, reset the weights, and went to look at the sea.

The next day dawned high and clear, and coming from my door out into the street I knew that I stood on the threshold of another year. Everyone else seemed to know as well, and when I ferried my papers and films to the skiff, the inshore catamarans were spinning across the sea like water skidders, long-legged and joyful in the sun. The rains were done, the society reaffirmed. Another chapter had begun.

I ferried my loads out to the ship and stowed them.

I went softly one final time through the streets.

I told Vekkar that I would leave Kattar early the next morning and he warned me there would be a crowd.

"How many people?" I asked.

"All the people," he answered. I didn't know what to say.

So instead I went down to the shore where the waves broke furiously and rolled in timidly and were pulled back into the sea. I borrowed a catamaran and raised the sail, and scattered out across the ocean, a chip of cork, a sliver of drift on the heaving breast of the sea. I ran north on the wind past Karnev's grove, but to him I was just another sail and I did not go ashore. Our quests were

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at an end, with new vistas opening.

I swept north, then, a bright leaf flown on the breath of the wind, and came at last to where the island trails away into broken pieces and tiny islets straggle out in the great current like the tail of a south-bound comet. I followed these out to the very last and cast a sea anchor off its rocky shore, to lie and watch the stars come out.

I lay on the trampoline and they came before me, ice blue and immensely fine. I slept.

I will never know how much it was chance, and how much the congruence of our minds. Far into the night, I awoke to the splash of water on wood, looked up, to see another catamaran dropping sail farther out to sea. My own could not have been seen, with the islet a great black block behind it. I stood up precariously, holding the mast.

"Hello, friend," I called.

The shadow on the distant trampoline started in surprise. In the answering voice I had my answer: Karnev.

We closed on one another beneath the incredible net of stars. Phosphorescence swirled in the deeps, a hundred galaxies of cold green fire. Our craft reached out toward one another, nearly bumped, and rocked in the silent air. We could not see our faces in the dark.

"What brings you here, man from the sky?"

"I came to see the stars. And you?"

"I came to give them a gift."

He reached down and lifted a bundle from the trampoline. The cloth fell away and I saw the dark, unnatural curves. His hull.

"That is a good hull," I said softly.

He looked at me in the darkness.

"It is the best hull," he answered.

"Think how you could sail with hulls like these."

Karnev sat silently. The jewel-studded horizon rose and tilted beyond us. The lashings of our boats groaned together.

"I could build this hull," he said, so softly I could scarcely hear. "It would be hard, but I could build her. And she would fly like the wind."

The stars cartwheeled above us, immensely slow. He stood up, the trampoline sagging beneath him. His silhouette looked out at the sea, up at the sky, out to the invisible seam where each flowed perfectly into the other. He was a statue in black, backdropped by the brilliance of my home.

The salt smell reached out to us, the phosphorescence coiled below. Karnev's back straightened, his arm shot out. Far, far away a splash broke through the web of the sky, and disappeared within it.

"I will build slow ships," Karnev said at last. "Those ships will be my own."

Beneath all the silent fires there was no sound, save the restless march of the sea. ■

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We could do it. Halley's Comet visits our part of the solar system in 1985-86. It won't be back until 2061. And we could, if we want to, get close to it, examine it, look at its structure, take more than 3000 "observatory phase" pictures and 5000 "encounter phase" pix, many of them from within the dusty coma, passing within 500 miles of the comet's nucleus . . . We really could.

Understand: I'm not precisely a disinterested observer. Of course not. The authors of *Lucifer's Hammer* have an intense interest in comets—and some expectation that a Halley mission will sell a few books for us.

With that out of the way, let's look at the Halley dilemma. It does pose a fairly knotty problem.

The Citizen's Advisory Council on National Space Policy recommends that NASA's scarce development funds be spent on expanding capabilities, not simply flying missions. Science is important, but NASA's primary job is to build tools and get us permanently to space. Technologies are more important than missions and, *for NASA*, are more important than pure science.

Since I'm chairman of that council, I obviously accept that conclusion. I don't have to like it, and I don't; but I am driven to it by current events: large budget deficits, double-digit inflation, and 20 percent interest rates. So: under those ground rules, does Halley make sense?

The Halley Mission would cost about $255 million in 1982 dollars ($300 million "real-year dollars" if our guesses about inflation are right); that's less than one tenth of one percent of our annual budget for social programs. Over at

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HHS (Health and Human Services, formerly Health, Education, and Welfare) they spend that kind of money in *hours;* the cost of Halley would be quite literally lost in the noise. Still, it is 300 million taxpayer bucks, and sums like that are hard to come by for NASA. Is Halley's worth it?

Current theory says that comets are among the oldest objects in the solar system. More than that, they are made of ices and frozen gasses, volatiles preserved for billions of years. Learning what comets are made of will help us understand planetary atmospheres. Some planetologists think comets contain clues to the origins of organic molecules.

Comets are, in a word, important for planetary sciences—and that's an area where we'll be wanting a boost about 1986. Sure, right now the U.S. is the world leader in deep space sciences. The Golden Age of the Seventies saw us getting first looks everywhere. Lunar samples. Martian landers. New pictures of Mercury, Venus, Mars, Jupiter, four Galilean moons which turned out to be worlds in their own right. Saturn, and its ring systems (complete with sheep dogs to herd the curiously braided F ring). Turn on the TV, and there were U.S. spacecraft sending magnificent pictures. (I recall Bjo Trimble at JPL during the *Voyager I* encounter: she looked up at the TV screen and said, "Ho, hum, it's just another goddam spectacular picture of Jupiter," whereupon we all collapsed into laughter.)

But from 1981 to 1985 there won't be any U.S. spacecraft sending back spectacular pictures of *anything,* and the world does tend to forget.

It's also a chance to put one in the Politburo's eye. The Soviets have invested a lot in their Halley mission. For example: Their original Venus mission had two probes and two orbiters. For what we think were financial reasons they cancelled the probes, but then they made a deal with the French to carry two large balloons which would float around in the Venerian atmosphere and send back a lot of nifty data. Then, suddenly, they got interested in the Halley possibilities—probably because it looked as if the U.S. wouldn't be doing anything with Halley. Much to the chagrin of the French, the Soviets greatly cut down on the mass allowed for the balloons, and also cut back severely on communications and support equipment.

The Venus probes, they announced, would fly by Venus and go on to Halley's comet. Moreover, they would arrive at Halley's *first,* and guide the European spacecraft to the comet. Take that, U.S.A.! (Better than winning an Olympic hockey game. . . .)

And that, just now, is how matters stand. The Soviets are going. We aren't.

But we could. And if we do, we'll get a *lot* better data than the Soviet machines will. Their closest approach will be about 6000 miles. Ours will be 500. (The European craft will also be about 500 miles out, but since it can't do optical navigation, there's a 50-50 chance the ESA probe will pass on the dark side of the comet, and thus won't see much at closest encounter.)

So: there are good scientific reasons for us to go; and we do show up the Russians. If we go.

The one thing we *can't* do is dither.

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The Halley decision has to be made before December of 1981. After that it will be too late.

Of course there's an obvious question: What's so bad about that? There'll be other comets, won't there? We don't *really* have to wait until 2061 when Halley comes back. Or do we?

After all, comets aren't rare. There may be as many as a billion of them in a kind of halo around the Sun. Most stay a long way out beyond Pluto, where we're unlikely to get at them for a century or two, but every year a few get jogged out of their orbits and go plunging down into the crowded regions where we live.

And there are reasons why Halley's is not an ideal comet. It has been around too long—at least since the time of Christ. (Some competent astronomers believe Halley's may have been the Christmas Star.) Every time a comet approaches the Sun, a lot of its ices and gasses boil away to form the spectacular tail, which can be several million miles in length. True, the tail is pretty thin—Earth passed through the tail of Halley's comet back in 1910, and nothing happened—but it does represent a considerable amount of volatile material that the comet has lost forever. If we want to study the origins of the Solar System, we'd be better off if we could get at a very young comet, one on its first trip.

The problem is that we don't know *how* to get at a very young comet. When comets first plunge down toward the Sun, their frozen gasses and ices boil furiously. Great jets of gas spurt out at high speed—just like a jet engine, and the effect is the same. The comet nucleus is driven hither and yon in a random pattern, making it darned near impossible to navigate spacecraft to it. After all, the spacecraft have to be launched well in advance of the comet's approach. If we go to Halley, we'll launch in summer of '85 for encounter in March of '86. Similar times would be needed to get at any other comet; and if the comet is jetting about randomly, we just couldn't be confident of getting close, not when comet and spacecraft have relative speeds of 130,000 miles an hour at encounter!

Of course there are a lot of older comets, ones whose orbits are known precisely, but they're not very interesting, because they've lost a *lot* of their volatiles. Halley's, it turns out, is about the youngest large comet whose orbit is known with sufficient precision to let us be certain of getting close. Thus the Halley opportunity *is* unique.

But is it worth it?

What will we get out of it?

Well, first, we *won't* get much in the way of new capabilities. Sure, the Halley spacecraft will be a bit unusual. It's to be shielded from the cometary dust, so that it can go deep inside Halley's coma. It will view the comet by looking in a mirror, somewhat reminiscent of the way Perseus slew the Gorgon. The optical navigation system requires some interesting new programs—my friend Dan Alderson, he of Alderson Drive fame, is working on one of them—and some of the computer guidance hardware is interesting. All in all, though, Halley's uses fairly standard equipment. It has to: this is to be a low-risk mission.

We *will* get fascinating new science. We'll show up the Russians in a harm-

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less way—I can't think of a better way for great powers to compete than by trying to learn about deep space. We'll help our European allies, and it sure ought to be as much fun as Olympic ice hockey.

It also helps keep the science teams together—and that's no small thing. We need their imaging capabilities, and right now they don't have many missions planned. True, we're all pressing for a lunar resources survey mission—theory says there ought to be water ice at the lunar poles—and we'll also want an asteroid survey; but neither of those missions is funded yet. Then too, there's Galileo, which *does* develop needed new capabilities, namely the Centaur upper stage for Shuttle (Centaur is a liquid hydrogen-liquid oxygen throttleable rocket); but Galileo may not go on time.

Conclusion: on balance, Halley's is worth doing. It doesn't cost much, it keeps the imaging teams together, it's practice for the lunar and asteroid resources survey missions, and it makes the country look good.

Next question: Can we get it?

And that depends greatly on *you*. Thanks in large part to science fiction fans, Washington now knows there's a constituency for space. Thanks to the L-5 Society (1060 E. Elm, Tucson, AZ 85719, $20/year and join now if you haven't), that constituency has been organized and coordinated. (There are other good pro-space organizations, but *I think L-5 is by far the most effective* group working for space development.)

I'm writing this in June for publication in the fall. A lot can happen in a few months. Things may change like dreams. By the time this is out, space may have won its battles: there is forming in Congress a Space Caucus with the goal of making space as popular—and as politically attractive—as the "ecology" movement used to be. (Why not? The best way to be kind to Earth is to move most of man's polluting activities to outer space. . . .)

But that's unlikely to have happened by the time this is published. The space development movement goes in fits and starts, and it's still an uphill struggle. If all goes as I think it will, Halley's will need—and deserve—your help about the time you're reading this. If you're in doubt, write anyway; it can't hurt to let the White House and Congress know your views.

And check with the L-5 Society, because by then there'll be other important projects needing your help. We science fiction people have arrived: we're in the vanguard of a revolution as fundamental and far-reaching as any in the history of Earth.

And we're winning. ■

● The most beautiful thing we can experience is the mysterious. He to whom this emotion is a stranger, who can no longer wonder and stand rapt in awe, is as good as dead: his eyes are closed.

Albert Einstein

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a calendar of analog upcoming events

23-25 November
General meeting of the American Physical Society at New Orleans, La. Info: American Physical Society, 335 East 45th Street, New York NY 10017.

30 November-1 December
Seventh Annual Conference, Mid-Hudson Modern Language Association at Marist College, Poughkeepsie, N.Y. Academic conference on Science Fiction and Fantasy. Info: [illegible], Dept. of English, Scott Hall, [illegible], New Brunswick, NJ [illegible].

4-6 December
CONCLAVE 2.5 (1981 Halfcon relaxacon) at Park Mammoth Resort, Park City, Ky. Info: Conclave, c/o UpperSouthClave, Box U 122, College Heights Station, Bowling Green KY 42101.

8 December
Computer Networking Symposium at Gaithersburg, Md. Info: Tom Stack, Network Analysis Corp., 301 Tower Bldg., Vienna VA 22180. 703-281-7440.

27 June-2 July 1982
JERUCON '82 (First International Integrative Congress on Science Fiction, Fantasy, and Speculative Science). Many world-famous SF authors will be in attendance. Info: Organizing Secretariat, Jerucon '82, P.O. Box 394, Tel Aviv 61003, Israel. (Use airmail.)

2-6 September 1982
CHICON IV (40th World Science Fiction Convention) at Hyatt Regency Chicago Hotel, Chicago, Ill. Guest of Honor—A. Bertram Chandler; Artist Guest of Honor—Frank Kelly Freas; Fan Guest of Honor—Lee Hoffman. Registration—$15 supporting at all times. Attending—$30 until 30 June 1981, higher thereafter. This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition, the works. Join now and get to nominate and vote for the Hugo awards and the John W. Campbell Award for Best New Writer. Info: Chicon IV, Box A3120, Chicago IL 60690.

—Anthony Lewis

Items for the Calendar should be sent to the Editorial Offices ***five months*** *in advance of the issue in which you want the item to appear.*

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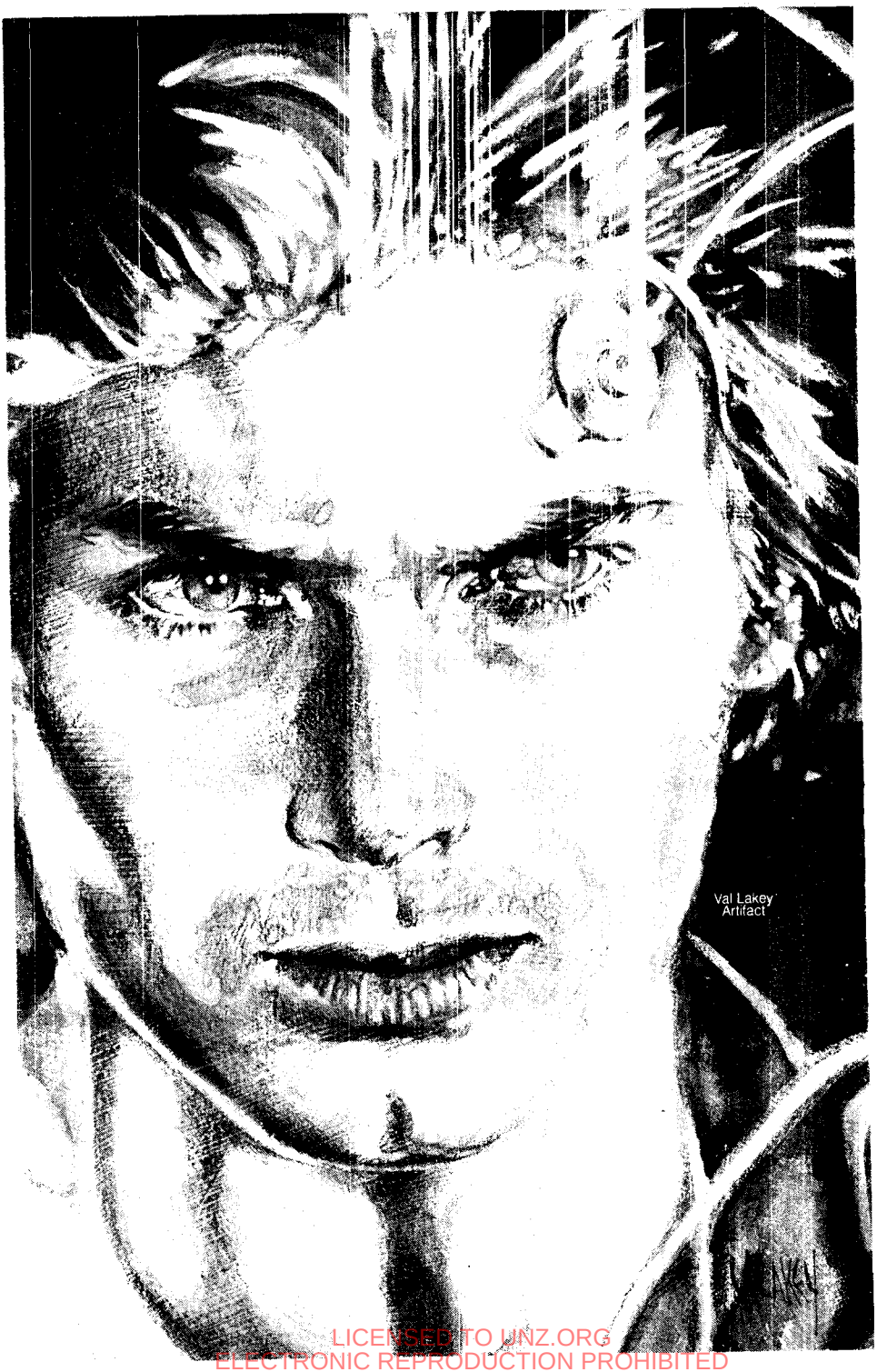

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Henry Melton

THE ANNOUNCEMENT

Suppose you had
one chance to make
an announcement to everybody...

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Glen Aldiman set his old black phone down on the only clear spot on the desk and with an audible stretch pushed himself out of his creaking chair. The three-foot stack of frayed and faded international telephone books to his right tumbled off onto the hard linoleum floor with a thud and a rustle. It seemed only just. He'd fought those outdated listings for two hours trying to find English-speaking strangers all over the world. He looked across the clutter on Jerry Mercer's desk. His research associate had been staring intently at the far wall. The classroom-sized blackboard was covered by the chalk graffiti understandable only to that brand of physicist whose mathematics had long since drifted away from the rules that made bridges and balanced checkbooks.

"Well. What do you think?" Glen asked. His voice was hoarse.

Jerry shook his head and closed his tired eyes. "I don't think we have any doubts. It works. Everyone on the face of the Earth heard a click . . . " Jerry glanced up to the wall clock, ". . . just two hours and thirty-eight minutes ago."

Glen nodded and sat back on the top of his desk. "Do you think we called enough people?"

He shrugged. "We called as many people as we could, in every country we could think of, and everyone heard it. A rulebook statistical sample for four billion people is beyond our abilities. And the university's phone bill! I'm convinced. So are you. It's not just a research paper anymore. We succeeded. We built the thing. It works, and we really don't need statistics to prove it. Our only problem now is what to do with it."

A frown settled on Glen's face. "I know." He sat back down in his chair. "We've got the world's most perfect public address system. Do you want to make an announcement?"

Jerry caught his tone and nodded. "What kind of announcement is worth bending the ears of four billion people? I'll scream if Madison Avenue gets hold of this."

"Or *Pravda*. I can't think of anything worse than having Official Truth broadcast into my mind on a regularly scheduled basis." He shuddered visibly.

Jerry pulled a silvery tool out of his pocket and began working on the cold ashes in the bowl of his pipe. He gestured with it. "Or, if you'll pardon me, some religious fanatic bringing enlightenment to the world."

Glen shook his head and smiled. "No. I don't mind." On impulse he got up to erase some of the more critical equations from the blackboard. "I'm not ashamed of my beliefs," he waved the eraser back at the other man, "but God is perfectly capable of doing a telepathic broadcast all on his own—without a plenum amplifier; and excepting the Last Trump, I don't read of Him doing so. Somehow I'm reluctant to push my ideas with a method He decided not to use.

"No. If I ever use that thing," he pointed the eraser across the room at a gray equipment rack webbed via a half-dozen shiny, black coaxial cables to an unfinished aluminum box resting on the workbench, "it'll have to be something that'll save more lives than it'll take."

Jerry puffed silently for a moment, then pulled the stem from his mouth. "I see what you mean. The broadcast

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bypasses the sense channels. People have to listen—because it goes in their thoughts. It would seriously disturb the concentration. Bad luck for a pilot landing a plane."

"Or a motorist in a tight situation."

"Or a surgeon with a knife."

"Bad luck for the patient."

"Right."

Glen returned to his task of erasing the blackboard. He went out and returned with wet paper towels and began washing the whole surface.

"Jerry?"

"Mmm. Yes?" He looked up from making ball-point pen entries in a bound notebook.

"Is there any chance we're alone in this discovery?"

"Don't know." Jerry sat back in his chair and rubbed his eyes. "How many people were there at Heinrich's presentation? Eighty—a hundred. And I'm sure he'll publish. You had the thought as well as I that his equations described something that could actually be built. I don't think we're unique. We're just the first to succeed. I'd bet another amplifier is in the works somewhere.

"I'm afraid this genie is out of the bottle for good. Our randomizer is the only real chance for control. And personally, the sooner we get it built, the better."

Glen nodded. "Two days' work."

"If it works as planned." Jerry shook off a yawn.

"The amplifier worked as designed. The theory is valid. Q.E.D."

"Optimist! I wouldn't bet even money I could get an electric toothbrush fixed on schedule. Certainly not an experimental gadget that exists only in equations."

"I'd argue. Everything is off-the-shelf. But you're probably right about timetables." Glen walked over to the workbench and turned off the standby power supplies. He paused at the last switch. "Perhaps I should leave this on?"

"Why?"

Glen said nothing for a moment, looking at the equipment on the bench. Then, "In two days, or thereabouts, we'll have this broadcast capability blocked off. We have an opportunity. Maybe we shouldn't blow it.

"We can make an announcement. We can send a message to everyone on the face of the Earth. There will be no restrictions. Distance, language, governments will be bypassed—everyone will hear. You remember the phone calls. Even the people who are asleep will dream the message strong enough to remember it the morning after.

"We have power. Neither of us seems to have a burning urge to use it—to contact the rest of humanity, but maybe . . ." Glen's voice drifted into silence as he worked on the thought. "The chance will never come again. The randomizer is so simple to build that once the principle is public knowledge, you can bet there will never be a time when one isn't running. There's only one channel on this 'radio' and once it's jammed, that's all there is.

"If there is something that needs broadcasting, and we're the only DJs around, shouldn't we at least give it some thought?"

Jerry puffed in silence for a moment. "No. I don't see the problem. I don't

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have anything earth-shattering to say. You said that you didn't either. Let's build the jammer, put it in operation, publish everything, and then let the world hail us for our restraint."

"Humor me for a moment." Glen returned to his desk, pulled a calculator from a drawer, and keyed rapidly. "I'm unsure of the ethics of something like this. We're both conservative. Better do nothing than do the wrong thing."

Jerry craned his neck to see. "What are you calculating?"

He didn't look up. "I'm trying to get a feel for the human cost to make an announcement. In addition to the accidents . . . " he tapped the keys again, "I figure each eight seconds of broadcast consumes about a thousand man-years of concentrated thought."

"And that's just on the Earth."

Glen looked up, puzzled. "What do you mean?"

Jerry grinned. "I mean the equation had no distance factor in it at all! You know that. Your announcement is likely to hit every creature in the universe with a mind/brain reasonably close to that of a human."

Glen paused to digest it. Jerry could see the wheels turning. "Does the lack of regular hallucinations on subjects Upper-Betelgeuseian mean we're the only ones here?"

Jerry shook his head, dismissing the idea. "Who knows? Maybe the signal is too alien. Maybe brain broadcasts are reserved for ten-thousand-year anniversaries. I don't know. I only know the equations."

"But if we do broadcast, we can't restrict it. I'll make a note that any announcement shouldn't offend E-Ts. What other criteria do you suggest?"

Jerry closed his notebook with a sigh. "You won't let go of this. Okay. I'll play. But don't think I approve of actually sending anything."

"Sorry. I've got one of my famous moral dilemmas. But you've lived through them before.

"I can't shake the feeling that ignoring this opportunity without a little more thought is wrong. We have a tool. Maybe 'do nothing' is the correct response. It's also too neat, a pat answer. If I can walk over to that bench and save ten thousand lives with a five-second announcement, and I blow off the opportunity . . . "

"Oh, I see your point. If the H-bombs were over the pole now, a warning could save millions, and I'd help you with it. But I don't see any great peril at the moment. I do see a lot of pain and death if you do make an announcement. Let it go. The risks are too great. Even with good intentions, a flubbed message would have you in lawsuits the rest of your life, if the enraged mobs didn't get you first."

Glen nodded. He had seen that specter as well. But he persisted, "Jerry, help me work this out. If there is an announcement to make," he itemized the points on the fingers of his left hand, "it should be as brief as absolutely possible, consistent with clarity. It should offend neither Aliens from Space nor the lynch mobs outside the door. And it should save a lot of lives."

Jerry shook his head and tapped ashes out of his pipe. "No. I can't get into this. You're pulling fantasy out of the air. Maybe there are people out there

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who would be happy to give you a script. The World Health Organization perhaps—certainly any group with a political or religious gospel to preach, but they are already pushing their beliefs with all the money and advertising time they can scrape up. As far as I can see, the only thing worth it would be a genuine emergency. Something with a real time-limit to it.

"We don't have that. So don't spoil my triumph with a made-up worry! We did a good thing. We built something that proves the world isn't our prison. We've tapped something in the mind that could open up a new age of human advancement. Maybe we can build spaceships that can ignore distance too.

"We also built a machine that's dangerous, but before we finished it, we designed the protection for it. We did good. We've certainly done enough. Don't borrow trouble.

"I don't see any emergency. So if you'll pardon me," Jerry got to his feet, "I'm going home to get a good night's sleep."

Glen said nothing. Their friendship was such that he knew not to push. Sometimes the itch in his imagination would not go away. He had few enough friends who could tolerate him when he had the bug. He let Jerry go with a smile. He'd have to resolve it himself.

Time crept in the deserted old physics hall. Outside the windows he could see students still wandering about the campus, even though it was past midnight. In two days there would be many more, even if the team should happen to lose. Football nights were always long. There was nothing like it, not since the days when Lyndon Johnson was a demon and Che Guevara was a saint.

But tonight he needed to concentrate on the problem at hand. Jerry was right. There had to be an emergency. A clear and present danger. A real fire in the crowded theater.

But was he right about everything? Was there no problem except in his mind? Was there a real need, right now? If not, he should get some sleep himself, or else work on the randomizer.

Glen leafed through several file folders and pulled out a set of block-diagrams. At least he could work up the parts list for the randomizer. Maybe something would come to him as he worked. If not, maybe there was no warning to give.

It was well past three when Glen was startled from his work by a sudden shout from dozens of voices outside. He felt a stab of panic—paranoid fear. He went to the window, and relaxed a bit. The placards told him politics wasn't dead on this campus; some midnight rally was breaking up. He went back to his work. It had nothing to do with him, or the amplifier.

Strange, he still shook. He hadn't realized he was so paranoid. Not enough sleep. A large empty hall. It was enough, he decided, to feed his imagination.

But the thought nagged him. There were many radical groups on this campus. How many would quail at grabbing some real power, especially if the randomizer design was lost, or burned in the process. He had sent that test click. Neither Jerry nor he had made any secret of their research project. How many people who knew Heinrich's ideas could put two and two together, and what kind

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of political beliefs did they have? Did he really have the two days they would need to get the randomizer in operation?

What a terrorist weapon the amplifier would make! Even without the propaganda, the induced accidental deaths would be a horrible threat. And what power group would forego the propaganda?

Terrorists weren't the only threat. Uncle was notorious for grabbing new developments in the national interest. Sure bet there would be no published randomizer design if that happened. If a secrecy lid was put on Heinrich's theories, what would come of all the other spin-off developments? Was that fated to happen as soon as they submitted their paper for publication? Or had Heinrich's work already started them looking? How much time was left?

Glen shook himself wide awake. "Okay, Jerry," he spoke to the air, "there is an emergency."

He walked over to the workbench and started the power supplies up in their sequence. He scraped a clear area on the bench and set his diagrams there. He unbuttoned his shirt and positioned a gel-smeared medical electrode to his chest and two more to his head. There was a microphone. He tested it with an oscilloscope.

Panic and the night chill fed his shakes.

It's a gamble. Suppose I'm wrong.

But suppose I'm right!

Clear your mind. Remember, it's the thoughts behind the words that are sent.

He picked up a diagram. He moved a switch.

"This is a world-wide telepathic announcement. Please take notes. This is the design for a jammer against this type of broadcast. Build it quickly. . . ." ■

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the reference library

By Tom Easton

Time Travelers Strictly Cash, Spider Robinson, Ace, $2.25, 200 pp.
A Spadeful of Spacetime, Fred Saberhagen, ed., Ace, $2.25, 214 pp.
The Changing Land, Roger Zelazny, Ballantine (Del Rey), $2.50, 245 pp.
Down to a Sunless Sea, David Graham, Simon and Schuster, $13.95, 320 pp.
The Divine Invasion, *Philip K. Dick,* Timescape, $12.95, 248 pp.
Windhaven, George R. R. Martin and Lisa Tuttle, Timescape, $13.95, 348 pp.
Nectar of Heaven, E. C. Tubb, DAW, $1.95, 160 pp.
Astounding Science Fiction July 1939 (facsimile), as ed. by John W. Campbell, Jr., memoirs ed. by Martin H. Greenberg, foreword by Stanley Schmidt, Southern Illinois University Press, no price given, 180 pp.
Fantastic Lives, Martin H. Greenberg, ed., Southern Illinois University Press, no price given, 215 pp.
Masks of the Illuminati, R. A. Wilson, Timescape, $2.95, 294 pp.
Creating Short Fiction, Damon Knight, *Writer's Digest Books,* $11.95, 215 pp.

The latest word I've heard is that Spider wants to stop reviewing for this magazine. According to Stan, he's getting tired of long lead times, of bad books, even of reviewing itself, and he wants to quit for awhile. He may be back, but until then mine is the only name you'll be seeing at the front of this column. I'll say here that I don't seem to be quite as concerned as Spider with long delays between book and review publication. They're a fact of life that both you and I must live with. I'll do what I can by giving the latest arrivals priority, but sometimes a book I don't get to right away will still seem to warrant comment. That's when the delay will be at its worst.

To repeat: The column is all mine now, all mine, mine, mine. . . . Except for the occasional guest reviewer Stan reserves the right to use.

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But back to Spider—he is leaving us, and he deserves a proper send-off, a hail and farewell, an *ave atque vale*. Fortunately, I have in this month's supply of books a golden opportunity for just that: **Time Travelers Strictly Cash.** It's a collection of four more Callahan's Place yarns—including the one about the farmer's daughter—other stories, and a pair of review columns. About Callahan's delightful Place I needn't say a word, except to note that in "Have You Heard the One . . . ?" Spider achieves the heights of punder—do you mind that sort of punishment? The other stories are mostly from *Omni* and include the obsessive "Soul Search," based on the intriguing notion that the supply of soul material is limited and the human population may be inversely proportional to the populations of other Earthly life forms. It reminds me of a tale I read long ago—title and author are lost—in which the population reaches the point where no more souls are available and new births cease. And then there is "God Is An Iron," based on the thought that if one who commits a felony is a felon, then . . . More to the point, it is a moving portrait of a woman found with a wire in her pleasure center, committing suicide in total bliss, and of the man who rescues her. There are "Serpent's Teeth," an irritating fable of child-parent divorce, and "Local Champ," a slight, logical fantasy. There is a totally nutty convention speech.

And there are the reviews. His first *Galaxy* column, "Spider vs. the Hax of Sol III," is here to show us how he began this branch of his career, establishing a tone he never lost. "RAH RAH R.A.H.!" is a *Destinies* piece, and it shows us a writer with total respect for the man who wrote *Expanded Universe, Time Enough for Love,* and many more, and did at least as much as any other one person to define modern SF. He's more enthusiastic than I am, but if you like you can put that down to my chronic cynicism, skepticism, or simply dyspepsia.

The book is fun to read, though I really should note that Spider's Callahan yarns don't share space comfortably with his other work. The moods are too disparate. But don't let that stop you from anything except trying to read it all at one go. Spread it out, a Callahan tonight, something else tomorrow, then another Callahan, then . . . It really is a fallacy that a collection or anthology must have a consistent tone. Why should it when nothing but compulsiveness forces us to read the book so quickly that we catch the inconsistencies?

A final word: Book reviewing is not story writing, but a writer's good points necessarily show in both. If we treasure that writer for his or her stories, we must surely read the reviews with pleasure, for there we find more of what we like, though it is necessarily diluted. With Spider's retirement (temporary, I hope) from regular reviewing, you lose your regular fix. You will be saved only if he uses the time newly on his hands to do more stories. He probably will. But here's this book, too. Buy it, and get happy.

Fred Saberhagen's **A Spadeful of Spacetime** is an anthology of original stories addressing the theme of time travel without time machines. He has used three poems by Robert Frazier to bracket a dozen stories. Roger Zelazny's "Go Starless in the Night" is a fable of revival; the corpsicle, a researcher in chemical and biological warfare, is revived and asked where to find the weapons he developed; his answer seems less poignant than Zelazny intended. Chad Oliver's "To Whom It

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May Concern'' contrasts moderns and primitivies to make a point obscured in mysticism. Orson Scott Card's ''St. Amy's Tale'' offers a wholly unlikely solution to the problem of civilization: start *truly* fresh. David Langford's ''The Final Days'' tells us that if we could tell when and how many future eyes are upon us, we might have a useful—and self-fulfillingly dangerous—clue to our own significance. Saberhagen's own ''Recessional'' is more surrealistic than Lafferty's ''Bank and Shoal of Time.'' Charles Spano's ''Grain of Truth'' is the tale of the Santa Claus apeman you saw here last December. Edward Bryant's ''Strata'' is a tale of temporal intrusion in the Wyoming wilderness. Charles Sheffield's ''Forefather Figure'' gruesomely addresses the location of memory in a cloned Cro-Magnon animated by a modern personality.

Some of the stories here are a pleasure to read, enough to make the book well worth buying. Yet a few—the Oliver, the Card, the Saberhagen—echo a note I find somewhat disturbing in modern SF, partly because I feel that note in turn echoes a theme in the larger society of which SF is a part. I find this echo in stories that, though they are competently written, full of juice and pith and even insight, seem to obscure their points in mysticism. In the world that surrounds our ghetto, we see the same thing in the Moral Majority that elected Reagan, that leans toward fundamentalist religion, that embraces creationism and other pseudosciences, that promises to emasculate the future as it starves science, education, and social justice into submission to its aims. Both these stories and our world display a lack of logical rigor, a fear of change, a reluctance to face what the future may hold. I cannot say such stories should not be written—though they do seem more than a little inconsistent with the ambience of SF, especially as it exists in this magazine—for as a form of literature SF must embody the currents of thought that circulate in its present social context, even when it struggles to make change acceptable. But I can say I regret seeing them. They are not the gloom-and-doom tales of the sixties which, despite their frequent railings against the future, were yet vigorous and assertive. They are tales of apathy, of acceptance, of resignation, ultimately of sheer depression, sheer funk. They whine, and I fear their meaning, the shifts in our world they may herald, the less optimistic SF that may follow.

I ask for logic and rigor and optimism? Not quite, for if I did, I would find fantasy unacceptable, and I don't. I enjoy fantasy, for though it may be mystical and magical and free of the humdrum logic we know, it is not, at its best, obscure or depressing. The nonscience, even the antiscience, is there to define a world of enchantment, of freedom such as we yearn for in our dreams, waking and sleeping. By its very nature, fantasy is optimistic.

So it is with Roger Zelazny's **The Changing Land.** Dilvish, a minor sorcerer, was once sent to Hell by Jelerak, possessor of Castle Timeless and master of the power emitted by Tualua, kin to the Elder Gods. Now Jelerak is lost in the north, and Tualua is going mad, causing the land about the Castle to shift dangerously and unpredictably. His lieutenants are struggling to master Tualua's madness in order to capture the Castle and Jelerak's position as master sorcerer. Other wizards struggle to cross the land of flux to claim their chance at power. And Dilvish returns from Hell astride the metal horse, Black, intent on revenge.

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Good triumphs, of course. That much is predictable, as are the deviltries and betrayals that punctuate the story and give us much of the fun in the reading. But the story is tasty for other reasons as well. There is the sorcerous version of the Big Bang, and there is the sidelong look at familiar bureaucracies. There is Zelazny, whom you can trust for enchantment.

David Graham's **Down to a Sunless Sea** is going to make a grand movie! It begins in a near-future New York, where economic and energy crises have degraded life until Europe is airlifting refugees to relatives abroad. One plane, a 797 with over 600 aboard, takes off. As it crosses the Atlantic, only a few hours of fuel in its tanks, its radio comes alive with word of the final war. Humanity destroys itself as the crew listens. Suspense mounts excruciatingly as they seek a safe place to land, find it, refuel, join up with a plane full of Russian women and children, and head at last for the only safety on Earth, a lone Antarctic base at the limits of their conceivable range. They make it, of course, but their adventure is a painful read. Graham will keep your tear ducts twitching throughout the last half of the book. You may want to read it all at one sitting, but I suspect you won't be able to. It will hurt too much.

There are problems at every level, from that of details—Prince Charles's engagement—to that of the ending. The American approach to the energy crisis seems exaggerated, and Graham's motivational disaster unlikely. Graham misunderstands the effect of radiation on genes—it is *not* temporary. Antarctica is not covered in soft snow, I understand, but in hard-edged, metal-ripping blades packed and sculpted by the wind. And Antarctica is unlikely to be safe when the planet warms up as he describes; I've heard too often of the possible icequake as the glaciers slide off the mountains all at once. Graham's colony's survival would be so uncertain that we have to call him a pollyanna.

Nevertheless, the book is a gripping, stirring read, and the problems are easy enough to ignore for the sake of being entertained.

In the end, Philip K. Dick's **The Divine Invasion** affirms the rôle of free will in a universe dictated by God. But on the way to that end! Dick repeats many of the themes of his last book, *Valis*, even to the knowledgeable beam of pink light, as he tells us of a God who, exiled, must return to Earth doubly enwombed, woman-borne, spaceship-borne, to fight the devil who has ruled our planet for two millennia.

> "There was a rupturing of the Godhead. A primordial schism. That's the basis of it all, the trouble, these conditions here, Belial and the rest of it. A crisis that caused part of the Godhead to fall; the Godhead split and some remained transcendent and some . . . became abased. Fell with creation, fell along with the world. *The Godhead has lost touch with a part of itself.*" (italics Dick's)

A brain-damaged, imperfect God Who must learn compassion. The Torah as heroine. Humanity as battleground. The primordial nature of the split personality. Dick is vitally concerned with making sense of the human condition. In this he resembles the greats of classic literature. Like them, he uses metaphor and personification to turn abstractions into highly readable and provocative stories. But like them again, he borrows his points—he says nothing we cannot recognize in the weaker or more academic arguments of predecessors and

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contemporaries, and we do wish for more philosophical originality.

Or perhaps we can say that Dick's philosophical originality lies in his contrast to the depressing stories I mentioned before. He is optimistic. He has faith in a future worth living. And where other SF writers play their games in the head—even Ellison does this, really—he plays in the soul, the heart of hearts. He must be horribly shocking to True Believers, though I doubt they read him.

George R. R. Martin and Lisa Tuttle have turned their pair of novelettes set on the world of Windhaven into an episodic novel, **Windhaven.** Maris challenges the inheritance of the right to use the wings built of the colony ship's fabric long ago, wins a conversion to merit, then struggles with the problems she has catalyzed, problems of acceptance of outsiders and of reverence diminished by secularization, of accident and loss and death. She is intensely human, richly and warmly portrayed, and her world is real.

But you know all that, don't you? You read the novelettes right here. All I really need to tell you is that the book contains a third segment, just as good (and perhaps better than the second). So what are you waiting for? Get thee to the bookstore! Go!

Nectar of Heaven is Number 24 in E.C. Tubb's saga of Dumarest of Terra. Has Dumarest found Terra yet? Is he even any closer? Has the Cyclan nabbed him yet? Has he found true love?

Dumbesillah! Duntesk!

A while ago I reviewed the first two entries in Southern Illinois University Press's Alternatives series. Now I have two more, one the promised facsimile of the July 1939 issue of **Astounding,** purely for the compleat collector. This is the issue that introduced A.E. van Vogt and Isaac Asimov, opened SF's Golden Age—according to the jacket copy—and was Campbell's first "great" issue, according to Stan Schmidt's foreword. More than that, it documents a timeliness the magazine—and SF—has always been proud of, largely in an editorial on atomic power.

The book adds retrospective comments by contributors van Vogt, Asimov, and Ross Rocklynne. They help revive our interest in this fragment of the past, but not nearly so well as do some of the ads buried in the pages. They were peddling great jobs then, folks—in radio, at $25, $50, even $75 a week; in government, at $1260-$2100 a year. Since *Astounding*'s rates were a penny a word, you can see that a writer *could* do rather well. A dozen novelettes or four serials were the equivalent of a fulltime job in Washington. You say you've heard that rates haven't kept up with the rest of the world? They haven't, have they?

The second Alternative is **Fantastic Lives,** nine autobiographical essays by Ellison, Farmer, Lafferty, MacLean, Malzberg, Reynolds, St. Clair, Spinrad, and van Vogt. (The alphabetical order there is not my whim, but editor Greenberg's, presumably to avoid hurting anyone's feelings.) Not all the essays are strictly autobiographical, however. Ellison prefers to talk of the writing and side-effects of "I Have No Mouth, and I Must Scream." Spinrad orients himself to the marketplace. Of those that reveal more of the writer's background, at least one reads much like meanderings from a psychoanalytic couch; I'll leave the question of identity as an exercise for the reader.

The book is both interesting and valuable, for it shows us a few of the forces

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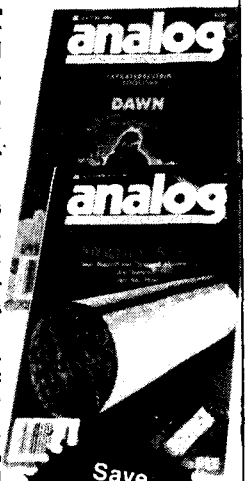

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that have shaped some of our reading. It is also valuable for its demonstration of why poor proofreading and the proliferation of typographical errors are a writer's nightmare. Among many lesser cases, one typo stands out as boldly as a crimson pea in a pod of green: "Intimations of Immortality" (Wordsworth; referred to by Farmer) becomes "Intimations of Immorality." Oy!

It is also interesting for the light it throws on the *Astounding* facsimile, a project justified by Campbell's reputation as a demi-god, or more. Lafferty says on pages 68-69:

> "But it is probably dangerous to argue that John W. Campbell was the *worst* disaster ever to hit science fiction (Oh that damned screaming! It's so predictable, so half-witted, so loud!); and yet it's quite true. Campbell had such writers as van Vogt, Heinlein, Asimov . . . Sheckley, del Rey, De Camp, Poul Anderson, and fifty others who were and are undistinguishable from one another. And the named ones are said to be the best (really most of them weren't), not the worst of the Campbell writers. But none of them was very good. It wasn't just that the emperor hadn't any clothes. He hadn't any skin even. He was plain obscene.
>
> "My own idea of what happened is that Campbell extracted the brains of all of them, put them in bottles . . . and inserted a programmed roll into each head. . . . Another explanation which I have heard is that Campbell had a strong personality and will and that he impressed them on a number of writing persons of flaccid personality and will."

Strong stuff, that Lafferty. Insulting, even. But maybe so. I've had my doubts myself, being inclined to view the 1950s

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as the *real* Golden Age of SF, but as I've said before, that may be simply because that's when I started reading the stuff.

Hey! Is that the secret? Lessee now. The folks who touted that facsimile idea to the publishers, who hung that Golden Age sticker on the late 1930s, must be in their—what?—fifties? Then they were about ten years old then, just about right. How 'bout that!

As you know, I have a fondness for Robert Anton Wilson's zany antics, as in *Schrödinger's Cat* and the *Illuminatus* trilogy. He's not quite as zany in **Masks of the Illuminati.** In fact, though he has James Joyce and Albert Einstein playing Sherlock to a refugee from cabbala and the Ordo Templi Orientis and gaining their respective illuminations fron Aleister Crowley, he is downright tedious for much of the book. It's a shame, too, for he has plenty of little gems, from a bawdy limerick to half a page of Walter Mitty's titles among the Secret Chiefs of the Illuminati. He has a point as well, embodied in the common theme of Joyce, Einstein, and cabbala, that all is not what it seems.

Last, but perhaps not least, we have **Creating Short Fiction,** by our own Damon Knight. The book comes from Writer's Digest Books, as part of their long list of aids for the would-be writer. In six parts, it discusses "Developing Your Talent as a Writer," "Idea into Story," "Beginning a Story," "Controlling a Story," "Finishing a Story" (and selling it), and "Being a Writer." It is not as prescriptive as Barry Longyear's book, for it focuses on the need for internal regulation, for building and cultivating a writer's mind-set, though it does not ignore the basics of story structure. Knight uses his personal history to illustrate his points, which must make the book of some interest to fans, writers or no.

Is the book worth buying? That depends on you. If you are a fan, go to it. If you want to write—and not just SF—remember that Knight has a reputation as a superior editor, writer, and critic and has long been involved in turning novices into SF writers at Milford and Clarion. He's worth listening to. I only wish he wouldn't so often use a generic "she"; he seems to imply that males don't read. ■

● As long as you are only biased it does not make any difference, because if your bias is wrong a perpetual accumulation of experiments will perpetually annoy you until they cannot be disregarded any longer. They can only be disregarded if you are absolutely sure ahead of time of some precondition that science has to have. In fact it is necessary for the very existence of science that minds exist which do not allow that nature must satisfy some preconceived conditions. RICHARD FEYNMAN

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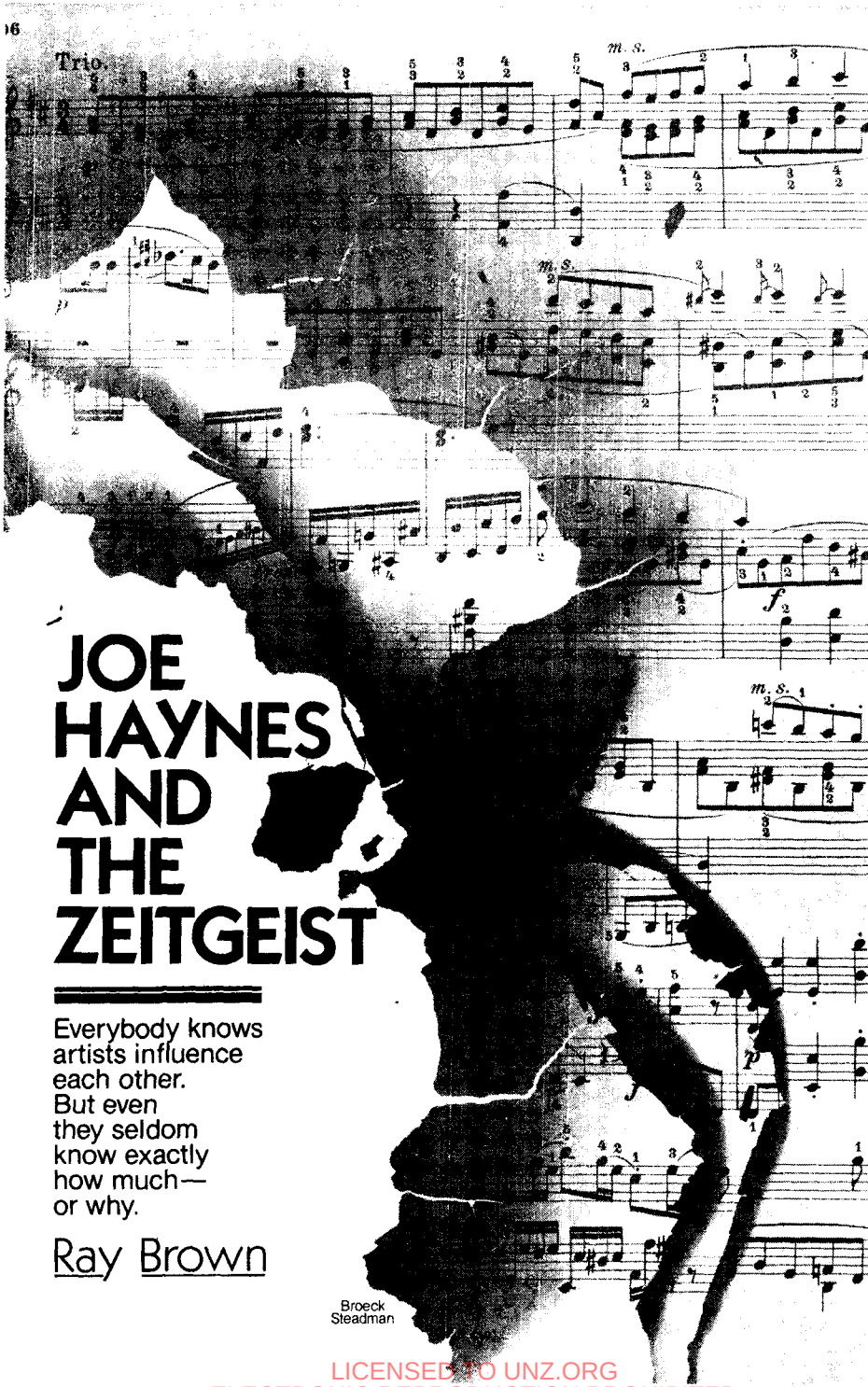

JOE HAYNES AND THE ZEITGEIST

Everybody knows artists influence each other. But even they seldom know exactly how much— or why.

Ray Brown

Broeck Steadman

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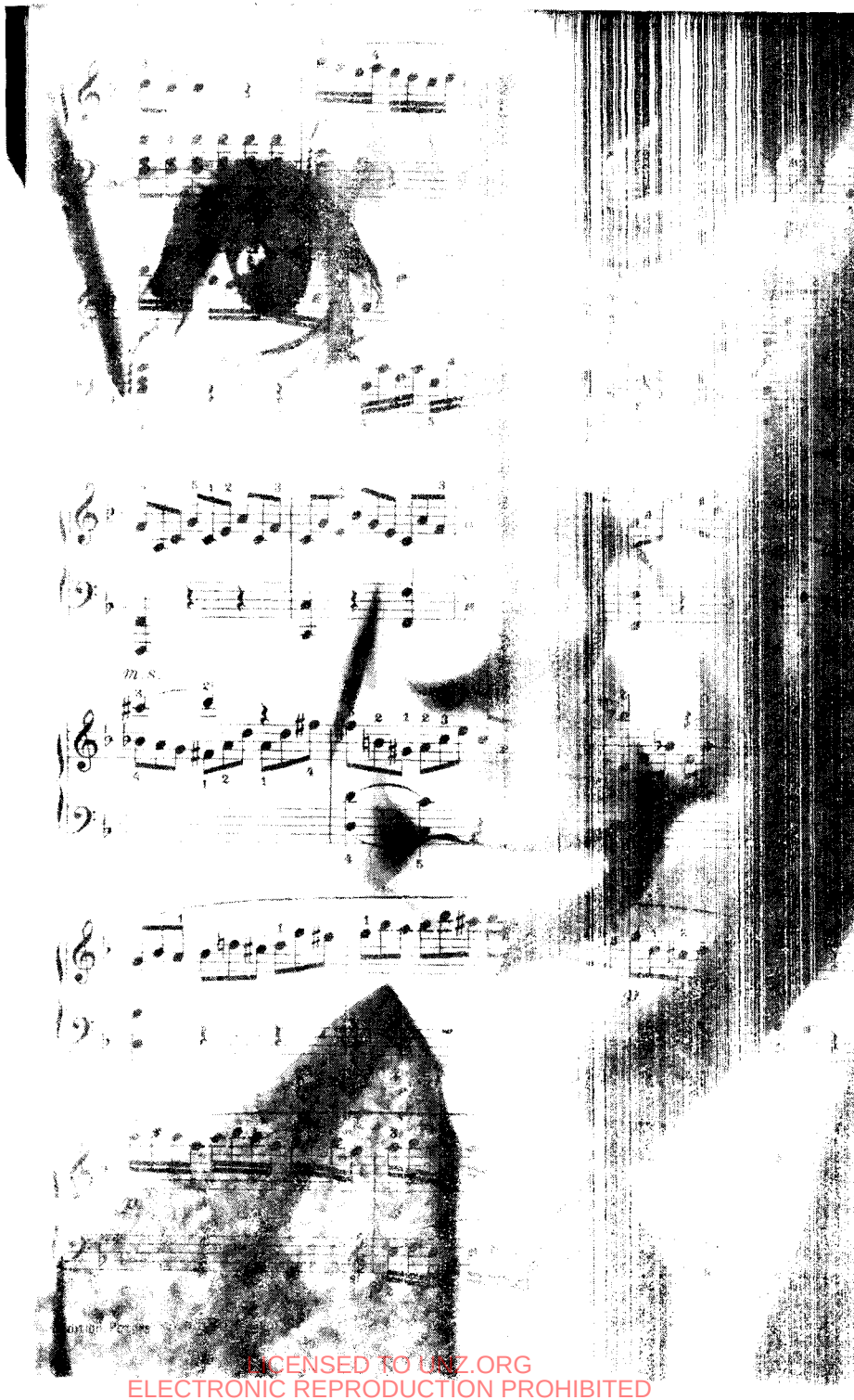
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Even though this is being published as fiction, it's a true story.

I know it's a hoary old convention of fiction to make that claim, and I don't really care if the average reader believes me or not. I just wanted to get it off my chest in case there are any psychic researchers reading this. *Them* I want to bother a little. My message to them is simple: go into another line.

It's not that I don't believe in ESP—I do—but hidden in the assumptions of every psychic researcher I've read is the idea that when they finally do get a handle on ESP, there'll be some use to it. In my opinion, they're in for a big disappointment. The only case of genuine, unchallengeable psi-talent I've ever run across was nothing but a joke on the man who possessed it. So remember, boys—the story of the man I call "Joe Haynes" is *all true*.

I met Joe in high school, not long after he decided to dedicate his life to composing music—and I mean that the way I say it. There are relaxed composers, who write and then turn their minds to other things (usually alcohol and sex, for some reason). Then there are composers who are obsessed by their work, who when they aren't sitting and scribbling on a sheet of music paper (which is usually) are brooding over their music, playing with their own heads, and talking about it. Always talking about it. Joe was one of these.

You have to be a real music-lover to get along with such people, and then it's only fun to know them if their work is good: being in on it from conception to first performance and playing it, if you've got an axe. Fortunately, I am a music-lover, and an excellent hornist. No Dennis Brain, maybe, but I've been offered jobs in major orchestras.

I didn't meet Joe till I was a junior. Lash High was no small, chummy high school—it was so big I never did meet all the members of my class. It was big enough to support an orchestra, and that's where it happened.

I was in my seat and unpacking my horn, waiting for the fourth-period bell to ring, when I noticed a skinny, intense little guy standing next to Mr. Ashe, waving one hand at some manuscript paper and running the other, which was trembling, through his wispy blond hair. After the bell rang Mr. Ashe passed out neatly handwritten parts and explained that we were going to play a piece by a fellow student—a *Festive Overture* by Joseph Haynes. The skinny one blushed and I made the obvious connection.

It was *good*—a dissonant, sarcastic, brassy piece that was such fun to play even our klutzes got through it without too many mistakes. The guy had obviously been influenced by Shostakovitch, but this was 1953 in the Midwest, so I sure as hell wasn't going to bring that up. And, in spite of the heavy influence, the piece showed a maturity that was amazing in a high-school kid. I was very impressed.

So after class I caught him in the hall and introduced myself. We traded in bullshit for a while and then I asked him, "You got any more like that?"

He smiled. "I'm afraid not."

"Well, you should get to work. That was good stuff."

"I know," he said, blushing again. "But that's not what I meant. I'm writ-

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ing all the time—it's just that I've become interested in other things."

"Like what?"

"*Serialism*," he almost whispered.

Forbidden fruit!

I'd heard of Schoenberg and his school, but I'd never heard any of their works. That's the way it was in southeastern Ohio in the early '50s; they just weren't available. There were rumors that you could hear them occasionally on the radio, but I sure as hell never did, and I had other things to do besides spending my life sitting by the set waiting.

Here was a chance to listen to real twelve-tone music for the first time. I was excited. "Have you got anything ready?" I asked.

"I'm working on a number of things simultaneously," he said—so—not yet. But I do have a sonata for solo violin that's almost done."

I offered him, for the next couple of weeks, and he agreed to get Judy Shrider, our number one violinist, to run through it. Outwardly he seemed to enjoy the rehearsing. I don't think anyone ever paid any attention to his music until then.

The violin piece was completely different from his overture. Since it was my first exposure to serial music, it was hard for me to understand, and we had Judy play it through three times. On the third time it clicked. It, too, was good. Better than good.

It dawned on me that I was acquainted with a for-real musical genius. I decided to stick with him and earn myself a footnote in his biographies.

The trouble started in our senior year. By that time Joe and I were already eternal friends, in the easy way youth has in such matters, and Mr. Ashe had taken it on himself to "encourage" Joe (as if he needed encouragement) by finding a publisher for his *Festive Overture*. We were sure that the first publisher to see it would snatch it up. I think even Mr. Ashe expected that, though he explained to us, carefully, after the first rejection, that such expectations were unrealistic.

But it kept on being rejected. That troubled Mr. Ashe, and was almost as agonizing for me as for Joe.

After we were well into 1954 Joe called me one night to share the news that Mr. Ashe had called him. Ashe had some news about his overture, and wanted to talk with him about it in the Studio during lunch break the next day. I decided to tag along, of course.

The Studio was a little glassed-in, soundproof cubicle off the band room. Inside were Ashe's office and a record-cutting machine. Ashe was waiting outside in the empty band room, and from the look of him he didn't have good news—it struck me that maybe we'd gone through every publisher in the country. Joe walked into the Studio and Ashe and I followed, but when we got to the door Ashe put his hand on my shoulder and said, "Wait outside please, Ray." He shut the door in my face.

I took a seat in the clarinet section and watched. At first, it looked like Mr. Ashe was screaming at him—his face went red and his mouth opened wide. Then Joe spoke for a while and Ashe's expression changed from anger to puzzlement. He compared Joe's score with something in his top desk drawer.

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shrugged, and patted Joe on the back. By the time Joe left, he seemed to be trying to hold back tears.

"What was that all about?" I asked Joe, as we walked to the lunchroom.

"I found out why they keep rejecting me," Joe said. He looked a little sick. "The last publisher we sent the piece to was nice enough to include a little note. It seems Shostakovitch brought out something a lot like it this year—even called it a *Festive Overture*."

"Well, that's great," I said. "It shows once and for all that you're at least as good as Shostakovitch."

"It was hardly one of Shostakovitch's best pieces," Joe answered seriously. "I write much better stuff than that now.

"It really is peculiar, though—whole big sections were so close the publisher thought they were plagiarized. Mr. Ashe thought so, too, but he was too upset to think straight. He recovered when I reminded him I wrote it last year. He got a copy of the score somewhere and showed it to me, and truly, it is awfully close."

"So? You proved you didn't plagiarize. And you were first!"

"Doesn't matter. Shostakovitch published first. And actually, we probably wrote our pieces at about the same time. It takes a little while even for Dmitri to get into print."

"That's not fair."

"I suppose not, but I'm not going to let it bother me. Anyway, I'm busy with other things now.

"You know, I think there might be something in using serial principles to organize every aspect of a work —instrumentation, dynamics— Webern pointed the way . . ."

He explained it to me over lunch. And the next day. And the next.

We roomed together at Ohio State University. He was in the School of Music, majoring in Theory and Composition, and I majored in something with a little more cash value and sort of floated around the edges, taking a few classes and playing in the orchestra.

I'm not knocking the Ohio State School of Music—it's a good school in many ways, but not exactly in the avant-garde. In fact, it didn't know the avant-garde existed. At the time we came there, serialism was just beginning to gain acceptance. Of course, serialism was Joe's main interest, so that was fine with him, and it made him appear an intellectual, revolutionary type among his backward peers, gaining him a degree of popularity he'd never have had otherwise. And this helped him in what he called his "social work"—hastening the acceptance of some really first-rate music.

Mostly, though, Joe wrote and studied. He'd mastered his course-work long before he took the courses, but he subscribed to *The American Composer* and the *Journal of Music Theory* and read and reread each issue. He sent all over the world for textbooks and recordings.

And he wrote, night after night, producing high stacks of filled music-paper. He talked about his works and his plans for future works continually. By his junior year he had produced thirty hours' worth of music, and I could have described each minute.

But, curiously, there were no performances. Aside from the rare occa-

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sions when he'd check himself out on the piano while composing, I never heard a note of it.

In 1957 though, our junior year, composition majors were required to give a concert of their works. About a month before that was to happen I caught him going to bed at a decent hour and I mentioned it to him as we settled into our beds.

"It's about time," I said. "Pretty as your voice is, I'd rather hear the orchestra tell me."

"I'm doing all chamber works," he corrected. "It's too hard to get an orchestra organized in the time I've got."

"Whatever." I pointed at a spot in a three-foot-high stack of manuscripts. "Your piano trio, maybe?"

"No. I'm going to write mostly new stuff for this. Listen, I don't want to talk about it, OK?"

"Don't want to talk about it? You always want to talk about it!"

He rolled over. He turned his back to me and actually shut up.

He stayed shut up, too. In the following month I hardly ever saw him. He did all his work in the Music Building, for a change, and I figured he was working on something pretty overwhelming.

But his concert was a disaster.

Three-fourths of it was chance music, which was taboo (and a good thing it was, I always thought—I hadn't thought Joe liked it, either). Various combinations of instrumentalists hurried through embarrassed performances of graphs and pictures and written instructions which were barely audible above the outraged growls of the audience, faculty included.

Faculty especially.

From reading the program, though, I knew something that nobody else did. The final piece was to be a reworking of the solo violin sonata he'd introduced me to in high school and that, I knew, was good old serial music. *Maybe there's some sense in this,* I thought. *After this stuff, even the conservatives in the audience should find twelve-tone rows a relief.*

It wasn't to be, though. After only a few minutes of impassioned sawing by the lonely violinist, one of the three pro-serial members of the faculty pointedly stomped out of the auditorium.

When I dropped in the Music Building for rehearsal the next day it was buzzing with the word: Joe Haynes had lifted Roger Sessions's *Sonata* for violin solo, made a few changes, and put it in his concert. He was being expelled as soon as they could type up the forms.

I ran to the dean's office—bulled my way right in past the secretary. Joe was there and he looked relieved to see me and pissed at the world in general at the same time. "You tell him, Ray," he said disgustedly.

The dean was intimidating. He *looked* like a dean: shiny bald head, x-ray glasses, and a permanent scowl. He was a great idealist and humanitarian, the scowl said, who had been disappointed in everything by the puerile, mean tricks of undergraduates. Still, I told him.

"1953, huh?" the dean said. "Well, it just so happens Sessions premiered this work in 1953. So it proves nothing. Do you know you're risking expulsion yourself with this nonsense?"

I thought it best not to remind him that I wasn't in his school. "Think a

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minute, dean," I said. "Even if he did finish it after Sessions, which I doubt, how could he have known?"

"He could easily have heard it. . . ."

"In Zanesville, Ohio?"

That stopped him. The dean had once been in Zanesville, Ohio. "Well," he said, "maybe you've got something there."

"Didn't Mr. Ashe see the music, Joe?"

Joe nodded. Luckily, the dean had a streak of fairness in him. He called Mr. Ashe, and after we compared dates and found that Joe had probably finished his score several months before Sessions's premiere, he let us go.

Joe even got an "A" out of the whole thing. After all, it had been proven beyond a doubt that he could write like Sessions.

But people shied away from him after that, as if he were hexed. There was a lame joke popular at the time:

Funny Man- Do you know what (any composer) is working on right this minute?

Straight Man- No, but I'm interested in his work. Tell me.

Funny Man- I don't know either. Let's go see Joe Haynes.

Joe continued to avoid me for the next few days until I finally cornered him in our rooms.

"Don't you think something funny is going on, Joe?"

"I don't think it, I know it." He grimaced. "I should have guessed about the violin piece, but I missed it. God! I was so sure I'd checked everything out!" He was yelling.

"What do you mean?"

He dug through a pile of manuscripts, pulled out a fistful of paper bound with string. He tore the string off and said, "Here's Sessions's Piano Concerto—that should have clued me. I finished it last year, a month before his premiere." He threw the unbound pages to the floor where they splayed out like a deck of cards.

"You mean this has been happening to you a lot?"

"It sure has."

"Have you tried changing styles, maybe?"

"I've tried everything." He began throwing music paper all over the room as he said, "In the past three years I've written Dallapiccola's *Canti di Liberazione*, Elliott Carter's *Variations for Orchestra*, and Kirchner's second String Quartet—all finished within five months, at the most, of their premieres."

"You certainly are a versatile . . ."

"It's not funny, dammit!" He was standing straight and panting now, eyes darting around our living-room-kitchen, having failed to find the Kirchner to fling. Then he spotted it atop the refrigerator. He marched over and scattered its pages in with the rest.

"I'm sorry, Joe," I said. "I truly am. Are they exactly the same?"

"No, but it's more serious than it was with the Shostakovitch thing. The two string quartets can't have more than a couple minutes' worth of difference between them."

"What about all the other music you've written?"

"I don't know. Maybe I'm just spooked, but . . . not every piece of music written becomes well known, you know. That's really what I was gambling on with the violin solo."

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"Jesus!" I said. I sat down.

Joe sat down too. We stared at each other across the strewn paper a while, then I said, "So that's why you turned to chance music. . . ."

"Right," he said. "And I'm going to keep doing it until I shake this thing. At least with aleatory stuff I'm not going to duplicate someone else's notes in performance."

"It's too bad."

"It's not as much fun as written-out music, but it's not a total loss. There are some interesting things to be done with chance music, I think. I hope."

I did my graduate work at another school entirely and didn't see much of Joe for the next few years. Joe stayed in Columbus on the theory, I think, that at least they were used to him at Ohio State. They might have thought of his compositions as suspect, but Joe had demonstrated the ability to teach music theory to even the most moronic tenor, and they thought that was wonderful. So Joe had security and the virtual promise of a professorship in the Theory Department eventually, if he couldn't find better. Not a bad deal, really, for a graduate student.

As his doctorate approached, it began to look like he wouldn't find better. He insisted on applying for composerly jobs, but had only aleatory compositions to show his potential employers.

Still, he was optimistic when I dropped in to visit him during my spring break in 1962.

He was sitting at his piano, smoking and flipping his ashes into the works—he claimed it improved the tone. He didn't even say "Hi," but started right in, picking up a conversation we had been having the year before.

"I told you there was something I could do with chance," he said. "I think I've thought of a twist that will get me some attention in the composition departments I'm applying to."

"Have you been composing any real music?" I asked.

He scowled. "A little. No luck yet. But back to my point—all the aleatory music I've encountered seems to be fixed—that is, there's a time span. The events—the notes, or whatever, in the music—are open, but the overall space is closed. Like Cage's *4'33"*: it's exactly four minutes and thirty-three seconds of whatever sounds the audience happens to make. Not four thirty-two or four thirty-four."

I groaned, but he went on. "What I've thought of is a simple switcheroo—make the events more or less fixed but the sequence variable." He grabbed the piano bench with one hand, leaned over and pulled out a tablet with the other, handed it to me.

Music paper had been cut up and pasted into the tablet, five pieces to a page. On the staves were various squiggles and lines and even an occasional note.

"Each page contains five possible events. The conductors . . ."

"Are you developing a lisp, or was that a plural?"

"There are two conductors. As I was saying, they have to decide, as they turn each page, which of the five events will be performed."

It was a good thing Joe had made some friends in the music publishing industry by that time. Hard-core music

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freaks will already have realized, of course, that he had composed Earle Brown's *Available Forms #2*. A buddy of his sent him a photocopy of page one of the score while I was there—before it had ever been set in print. Even the squiggles looked pretty much the same.

After we got our doctorates, Joe wound up with the Ohio State job and I found myself working in Baltimore, so we still didn't see much of each other. We wrote, though, and through his letters Joe told me he considered the *Available Forms* incident a kind of blessing in disguise. Since it proved chance music was no escape, it freed him, at least, to write what he wanted to write. He kept plugging away, trying different approaches. During that period he wrote pieces duplicated by Searle, Blomdahl, and even Stravinsky.

Joe and I corresponded on the possibility of ESP, but we'd considered it in the old days, too, many times. It always seemed to me that Joe had to be reading minds somehow, and since Joe knew damn well that he *wasn't* reading minds, our discussions always ended there, without moving on to consider more subtle possibilities.

In 1971, after a nine-year gap, I got a transfer back to Columbus. I renewed old acquaintances and made some new ones, including Dr. Gunther Diez.

Diez was a big, broad German full of easygoing, beery cynicism who had got his department—psychology—interested in research in parapsychology. The funds had dried up after a couple years, though, probably because of his attitude. He was cynical about *everything*, including his specialties.

We were drinking in a campus bar one cold night in early November. He was complaining about the end of his research.

"If I'd had just one good subject, just one, the money would still be rolling *in.*" *He shook his head mournfully.* "Even a good fake would have done the job. But they're all so simple-minded, you know, when they try to fake it. A child, even, could see through their tricks."

"It figures that it would be hard to find one," I said. "It seems to me the people who actually had ESP might have good reasons for wanting to conceal it. A man who could predict the fall of the dice would never get in another crap game if it became known. And forgetting the personal gain aspect, most people would shy away from being displayed as freaks." I thought of Joe's touchiness.

Diez laughed. "That is what many of my associates tell themselves. Self-delusion, I think. If the real article were out there, surely Rhine would have turned one up, after all these years."

"Hasn't he?"

Diez shrugged, smiled a sour smile, and said nothing.

"What if I told you," I said, "that I could show you a genuine, verifiable psi-talent, under the condition that you kept it quiet."

"If I kept it quiet, what good would it do me?"

"At least you'd know there is such a thing. It might give direction to your research if you get it started again. And you might learn something."

Diez narrowed his eyes. "Are you serious?"

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I stopped short then, and thought. Joe would probably be furious. But Diez seemed to know his stuff—maybe he could help.

"I'll introduce you to the man, if you promise me your silence."

"He is a fake. You'll be embarrassed after I show you how he does it."

"So I'll be embarrassed. But swear."

Diez swore, so I told him all. He insisted on going to see Joe right away, that night, to my surprise, so we got Joe on the telephone and gave him warning. Joe sounded uninterested but not actually hostile, and Diez chose to take that as a warm welcome. He dragged me to his car and we drove to Joe's house in Grandview.

Joe was somewhat distant when he opened the door, but he warmed up after I introduced Gunther, who assured him that he would not breathe a word without Joe's permission and asked for a beer.

Joe brought us a big bottle and three tumblers and said, "If you can help me get rid if this thing, Dr. Diez, I'll buy your beer for you for a year."

"You couldn't afford it," Diez snorted, and got directly to business. He wanted a demonstration. He snatched a piece of music paper off the piano and proposed to go upstairs and write something while Joe concentrated on him and duplicated it downstairs.

"It doesn't work that way, Doctor," Joe said.

"So I have been told. But I have to establish this for myself."

Joe smiled and agreed.

After that test proved a bust, Diez asked him what he was working on now, and Joe led us to the kitchen and a table covered with scorepaper. He sighed and said, "It could be anyone in the world, but most likely it will turn out to have been duplicated by a major composer."

Diez peered at Joe intently. "Why," he asked, "do you persist in this? I would have been discouraged long ago."

Joe shrugged. "I keep trying different approaches. Sooner or later I'm bound to hit on something no one else is trying. At least that's what I keep telling myself although, truthfully, I'm composing less and less."

Diez nodded and said, "Can you part with any of this music? Is there perhaps a section finished already?"

"What do you want it for?"

"I want to write a few people about your problem . . ." He held up his hand before Joe could object. ". . . in a modified way, only. I will say that I got it from one of my subjects while I was running my parapsychology project. I want to carry on a search for the uh—other composer, to ask him a few questions."

Joe dug out a few pages and handed them over. "I've already done a little looking," he said, "and I'm pretty sure it isn't an American."

Diez nodded again and dragged me out of there, eager to get on with the search. "He is a more clever fake than I have thought," he said on the drive back.

I got a call from Diez not too much later—a little before Christmas. It didn't take him long to find the answer, because it was in his own country. Hans Werner Henze was the other composer. Joe was expecting us, Diez said. I was to pick him up at seven.

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When Diez lumbered into my car he said, "You know, Ray, I think maybe after all this is over I will give up the ESP game."

"What do you mean?"

"Look here. The only man with demonstrable psi-power I've ever met—what does he want me to do? He wants me to *cure* him of it. If I'm successful, I will never be able to prove he had it. It's foreign to the whole field, this concept of ESP as a curse to be lifted. And, you are right, those people at the crap tables are never going to reveal themselves. No, no more. Primal scream therapy is becoming big. I think after this is over I will go into that."

"So you don't think he's a fake any more?"

"He is definitely genuine. No way could he have communicated with Henze, except mentally."

When we got to Joe's, he was taking it calmly. He asked us to sit and gorge ourselves with beer and Diez accepted happily.

After we got settled Diez said, "Herr Henze was good enough to write me a short letter about this, mostly having to do with the common-law copyright. But from what little he said, it seems that some of this work, Mr. Haynes, you have actually written a little before Henze."

"I told you it wasn't mind-reading," Joe said to me.

"Precognition!" I gasped.

Diez waved his hands at us, saying, "Let us forget about the preconceived categories for a while. Some of it also seems to have been written a little bit after Henze."

"I'm still not reading minds," Joe said, bitterly. "I work hard at my composition—hell, I sweat blood. My work is my own."

"All right," Diez said, "if you insist on talking about it—why shouldn't it be telepathy? You are saying that it feels to you like you are composing, but is there any rule that says telepathy shouldn't feel like that?"

"I suppose not, but . . ."

"Let's get back to that later. From what your friend has told me, your problem is becoming worse. That is, your works are matching other works more closely all the time. Right?"

"That's so."

"You have a theory, right?" I asked Diez.

"Of course. Now, Joe, you told me before, I believe, that you keep trying to think of something new, to escape this?"

"Within certain confines, yes. I mean, if you were utterly revolutionary, *nobody* could understand you."

"Aha!" Diez roared. "But all musicians are searching for something new, are they not? All artists do that these days, within certain parameters."

"There's some truth in that, I guess. They always have, really."

"So, in effect, you are concentrating on the same things all other composers are concentrating on."

"Hmm. I see what you're getting at, I think," Joe said, and quoted: " 'It steam-engines when it comes steam-engine time.' "

"I beg your pardon?"

"It's happened before in the arts. People think of the same sort of thing at the same time. But . . . that's no good; they don't think of the same

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themes with the same developments. Well, it's been known to happen, but very rarely."

"Still," Diez said, "it has happened. Perhaps the people involved had the same talent as you, in a small degree. But you have a big talent, and you continually improve it. Your constant focus on what is likely to happen in the world of composition attunes your talent to whatever other composer there is who is working on the same problem."

"If it's telepathy, then how is it that parts of my work are written *before* the other composer?"

"Come now, telepathy can work both ways, you know."

Joe's face blanched. "Oh," he said.

"With you, it is working both ways. It is an interaction with the mind of the other composer in the realm of pure musical ideas. So you both contribute and neither of you is aware of it."

Diez stopped, sighed, and took a long drink of beer. "And now," he said at last, "you want my advice."

"If you please."

"I don't know, you see, if there is any help for you or not. But I think you should stop worrying about composerly problems. Forget about what will happen next. Write something, say, in the style of Haydn. Do that for a while, and maybe your talent will atrophy."

The day after Christmas Joe began work on a slow, sweet piece for string quartet in approximately the style of Beethoven. He explained to me, solemnly, that such a piece would never stand a chance in the world of music as it was in 1971, but that it was so much fun to work on he didn't care. He played it for me on the piano—it was almost cloying, but, as usual, showed real talent. He finished it in January of 1972.

In May of 1972 George Rochberg premiered his third String Quartet. Part B of that quartet was Joe's piece, and this time the correspondence was note for note, through all sixteen minutes.

As Rochberg explained it, the music of the twentieth century had become one-dimensional and degenerate and egocentric. It was time to abandon the old notions of "originality," and move toward a music where even old-fashioned tonality was permissible. Other composers soon followed, with something very like relief.

And that was when Joe gave up composing for good.

I've moved away again since then, and Joe doesn't write me any more. I suppose the memories I bring back are too painful. But I do write to Diez, and although Joe won't talk to him either, he's been able to pick up some news through his friends at the music school.

It's good news, basically. Joe is still a creative person, and he hasn't let this thing get him down; he's simply found a new outlet for his creativity. He's been working on a fat music theory textbook for the past three years and some of his theoretician buddies say that the ideas in it are "revolutionary."

And his work isn't all pedantic, either. Recently, he's been trying his hand at short stories.

Say, I hope he hasn't tried to . . .

No, never mind. ■

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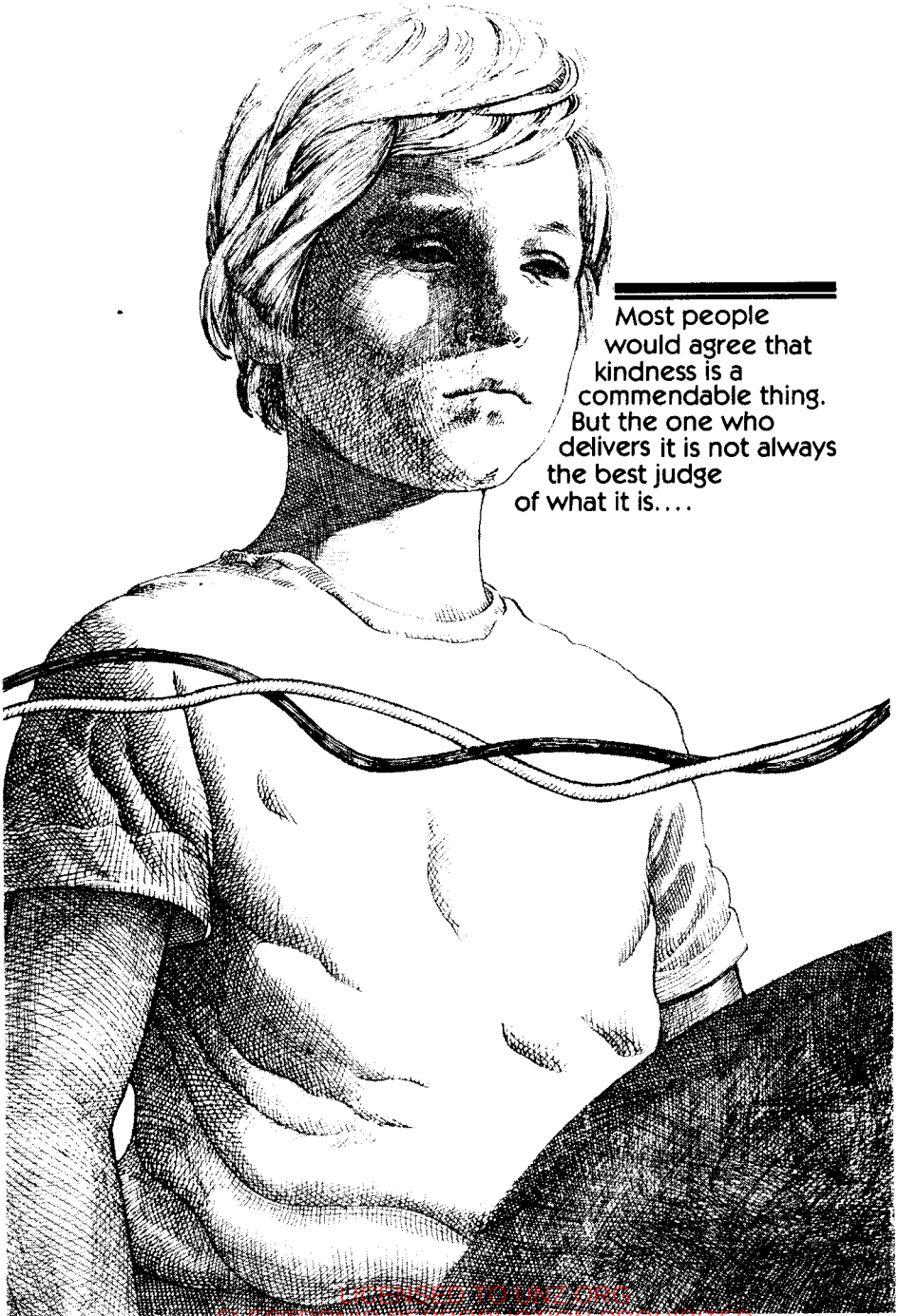
Most people would agree that kindness is a commendable thing. But the one who delivers it is not always the best judge of what it is....

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Al Sarrantonio

THERE IS A HOME

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". . . when the man was no more
than a voice
In the white winter of his age, to those
With whom he dwelt, new faces,
other minds . . ."

Alfred, Lord Tennyson

Bobby was leaving.

He would have asked Old Carl the way to the bus station, but Old Carl just sat in his wicker chair in the corner, staring off into space. Bobby knew what Carl saw; Carl had told him once about the river he was on, and the fishing he and his brother did from their clean white boat, and the trout suppers they had after the fishing was done, and the smell from the campfire, and the woods, and the fish all mingled into one delicious smell. Carl was on the river all the time now.

He went up to Old Carl, who had always been one of his favorites—had always told him that little boys were made for running away and that he didn't belong in the Home anyway, that he should run away—and he touched Carl's head above where the plugged-in cable was and said softly, "Good-bye." There was no response, but the smile that played around Old Carl's face, and the peaceful, distant look in his eyes, told him that Carl would be all right. "Don't worry about me, Bobby," Old Carl had said to him, "it's my time to be here and yours to be out in the world." The old man's arm, so thin and blue that Bobby could almost see through it, the skin the color and contour of the parchment map his father kept in his study, had pointed out through the window. "And I mean beyond that wall," the old man said, "where all the adventure in the world waits for a little boy like you. There might be pirates out there still, or places where no one's ever been, in space or under the ocean, things to store up here." The old man's fingers, trembling slightly, wandered to the top of his head above the thin cable and tapped feebly at his skull. "Put it up there," he said, letting his hand fall down into his weak lap, "and go to a river—I'll be with you." He wandered off then, as the dream-relay kicked in, and Bobby knew the old man was gone, back to that river.

Just like he was gone now.

Bobby wandered through the long corridors, through the open courtyard and garden, saying good-bye in his own way to the other old friends he had gotten to know. There was Jemima, who only plugged the cable in once a week because she said she still had a bit of living in this world left to do yet—she was a nice lady who hadn't been there long, and Bobby didn't tell her he was running away because he thought she might argue with him that it was his place to stay with his father. And there were Bill and Jake and Henry, the three who played pinochle most of the time when they were out of their dreams; Jake had tried to teach Bobby how to play pinochle because he said Henry was starting to wander and that soon they'd need a third player to keep the games going. And Ruth. Ruth was the hardest to say good-bye to. Ruth was in many ways a mother, or at least grandmother, to Bobby. She was the reason he was leaving. He found when he got to the door to her private room he couldn't go in. She hadn't had a private room until two weeks ago, and Bobby knew that if he went in he

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wouldn't even really be able to talk to her because she wasn't really there any more. She was gone forever. The stroke had done that to her, his father told him, and she would never be able to disconnect the cable and talk with him again. She'd stay that way until she died, and Bobby didn't even want to have to see her the way she was now, propped up in bed with one whole side of her body as rigid as stone, the other half merely lifeless.

He walked from her door to his own room, lifted his packed bag, and, avoiding his father's office, went out across the lawn and through the front gate. He took one long look back at the white stone building, bright in the sunshine of April and looking more like a museum or mansion of an old president than a Memory Home, and then turned away.

I will never go back, he thought.

He walked briskly to the bus station a half-mile away and patiently waited until the next south-bound arrived. In three hours he would be in New York City. Carl's world beyond the wall.

He sat by a clear window near the front of the bus, putting his bag on the empty seat beside him. For a while he watched the upper-New York countryside roll by, everything green and washed-looking in the early spring weather. A hologram billboard told him, three-dimensionally, to eat McDonald's hamburgers; there was a picture of Ronald McDonald on the sign and as the bus passed it the figure turned with it, holding out a hamburger in one hand and a milkshake in the other, smiling. There were other billboards, and a regular flat-painted sign that said New York City was only 50 miles away and that he should stay at the Statler Hotel when he was there. Bobby thought he would take the advice, since he was now having some time to think and really had no idea what he was going to do when he got to New York.

In Yonkers Bobby was slightly startled out of his window-watching when a woman asked him to move his bag so she could sit down. Bobby smiled self-consciously and did so, and when she sat down she immediately introduced herself as Emily Meyers. Bobby didn't really want to talk, but he didn't see any way out of it, and he was afraid if he didn't she might think he was in some kind of trouble and bother him even more. He mumbled a few short answers to her questions: How old was he ("Let me guess—ten, right?" and Bobby nodded) and where was he going, and before he really knew what was happening, he was talking to her as if she were Ruth.

Ruth. She looked like Ruth, though younger; she was about fifty-five, he thought, maybe sixty, and she was much more animated than Ruth ever was, but there was something there, a gentle resemblance, that made him open up to her immediately.

She was on her way home from visiting her daughter in Westchester; her daughter almost never visited her so she had to take it on herself to do the visiting. "It's not that she doesn't like me anymore, nothing like that, but—and she's told me this—there just isn't any time for everything any more. Do you know what I mean, Bobby? There just isn't any time any more. And I think I know what she means. It seems the

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older you get the faster everything whizzes by. Almost like God was turning up the speed every lap you take so you'll get to the end faster. I don't know why it works that way, but it does." She patted his arm. "Oh, you don't know what I'm talking about now, but you will some day."

"I do know what you mean," Bobby said. "Old Carl—"

He stopped, afraid that he might say something that would give him away.

"Old Carl?" said Emily. "Is he your grandfather?"

"Just a friend. A friend I used to know."

Her eyes sparkled, as if she sensed a mystery here. "Well, what about Old Carl?"

"Nothing. It's just that he used to tell me the same thing, about time going faster. He said that's why he was glad he could go back to when it didn't go fast—" The words had come out in a rush, and he knew he had said something wrong.

"Go back?"

"Yes, Ma'am."

"Do you mean go back like at a Memory Home? Is that where you knew Old Carl?"

"Yes."

She smiled down at him and patted his arm again. "Oh, don't look that way; I knew you were running away from somewhere or something as soon as I sat down. Is it Old Carl you're running away from?"

Bobby was startled. "No! It's, well, it's . . ."

"Hmmm?"

"I'm running away from the Memory Home. From my father."

"That's a pun of sorts, Bobby, isn't it—running away from *Home*, with a capital H."

Bobby liked this lady; he couldn't help it. He knew now that she would probably get everything out of him: why he was running away, everything—but he didn't really care, because something told him she wasn't the kind to make him get off at the next bus stop and make sure he took the next bus back to Albany. She was the kind who, well, would help him; even if it meant not making him go back.

Emily turned away from him for a moment, and began to rummage in her handbag. Bobby thought it was to look for a handkerchief or some other old-lady thing, like he had seen the old women at the Home do so many times, and he turned his head away, embarrassed to be seen watching her do such a thing, but when she suddenly gave a little "Ah!" of pleasure he looked back to see that she had produced a bag of lemon drops. "I knew that was in there; take one," she said, offering the bag. "Now tell me. Does your father work at the Memory Home?"

Bobby said, the piece of hard candy clicking against his teeth as he spoke, "He runs the Home."

"Oh."

There was a trace of something, disappointment or dissatisfaction, or something like it, that crossed her face for a moment; but she smiled quickly again, warmly, and gave his arm another pat. Her eyes were very soft. "Your father is Vernon Buckley, isn't he?"

Bobby was surprised by the fact that this woman would know who his father was. "You've *heard* of him?"

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"Oh, yes, Bobby, I've heard of him. Just about everyone has. Your father is a very famous man."

"He is?"

"Oh yes. And there are a lot of people who don't like your father, Bobby."

He looked up at her, mystified. His father had always been a monumental, unapproachable figure, a man to be listened to and not spoken to—but that had been only for himself, he'd thought. The fact that other people might feel the same way about him—that they would even *know* about him—was awe-inspiring. "Why?" he said.

"It's . . . hard to explain, Bobby. He's done some things that a lot of people like me don't really approve of. There are others who feel differently, and think he's done a lot of good, also. He's what you would call controversial. It all has to do with his work at the Memory Home."

This was another novel idea to Bobby, since he had never pictured his father as really working at anything. He had only been a sort of landlord, watching over Old Carl and Ruth and the rest; the Home had just been a place where they all lived.

"Bobby," Emily said, and he saw that her face was very serious. "I want you to come home with me in New York. I really think it would be best if you came and stayed with me for at least a few days. What had you planned to do when you got to the City?" He saw a look of hope, a very careful look, on her face now, and he didn't know what to make of it.

"I didn't know what I was going to do. Check into a hotel like the one I saw on a billboard. Old Carl told me all about hotels."

She shook her head and he thought she was going to laugh. "No, no, Bobby—you come with me. Hotels can be dangerous and there's a lot of trouble you could get into by yourself. There's no one you know in New York?" Again that measuring look.

"No."

"Then it's settled."

The note of finality in Emily's voice at once soothed and almost panicked him; the truth was he didn't really know this woman at all, and to go with her might be the kind of stupid thing Old Carl had always told him people were always doing in the City who weren't used to it. But he was sure she was all right; he felt it. And he had nowhere else to go. Taking this chance was better than wandering around alone or turning back to Albany. He nodded slowly. "Okay."

She smiled, and gave him another lemon drop, then turned for a while to read her magazine; and though Bobby spent the rest of the trip looking out the window he couldn't help feeling that her eyes were always on him.

New York was immense; even as the outskirts began to reveal the true size of the metropolis Bobby began to realize what a crazy thing it had been for him to come here alone and to expect to find his way around. The chance meeting with Emily seemed more and more like a good thing.

They got off at the Port Authority Bus Terminal, and Bobby followed Emily to the subway where they boarded a downtown train. Over the roar of the ancient railway works she explained to

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him that she lived in a section of the city that used to be known as Little Italy; it was now known as Oldtown. "It's a sort of ghetto for old people," Emily explained. She laughed when he asked if there was such a thing as "Big Italy." She held his hand a little too tightly, Bobby thought, and she seemed nervous; but she talked to him almost constantly and her smile that reminded him so much of Ruth was still there, so he really didn't worry about it. Everybody; in fact, seemed to be in a hurry, and the strange smells and sights kept what little part of his mind was left for worrying from doing just that.

They got off the train at 8th Street and went up the stairs to daylight. The afternoon sun was still brilliant, and cut sharp shadows on the sidewalks and street. Bobby was surprised at how dirty the neighborhood looked. There was garbage thrown out into the middle of the road, and there weren't any houses like Bobby had half expected—just tall brick buildings that looked like factories; in some of the buildings with windows Bobby could see women at work on sewing machines.

Emily, still holding his hand tightly, clutching both of their bags in her other hand, led him up a rickety stairway to a locked glass door with cracks in it; she pushed a button and a moment later a window opened above and a grizzled old man in a T-shirt squinted down at them. Emily yelled up to him and when he recognized her voice he nodded and ducked back in. A buzzer sounded and Emily pushed the door open.

"Old fool," she said, but Bobby could see that she was smiling. "Come along, Bobby. We're almost there."

Once again she led the way, this time up three flights of creaky steps. "The elevator doesn't work anymore," she said, as they passed a rusty box with a small broken window in it.

When they reached the third floor and stopped in front of one of the three doors, they waited again while someone inside removed what sounded to Bobby like a hundred locks. He found that he was a little scared, but the comical face that greeted them when the door opened immediately buried his worry. It was the face of a circus clown, in white and red paint, and the delightful grin it exhibited almost made Bobby laugh out loud. He noticed quickly, though, that the man's real lips, inside the painted smile, were not smiling at all, and that his eyes were anything but merry.

"Who the hell is this?" the man said gruffly, hurrying the two of them into the room and immediately locking the door behind them again.

Emily only smiled at him, and put their bags on the floor.

"You wouldn't believe me if I told you," she said. Her voice had suddenly lost some of its sweetness.

Bobby now noticed that there were three other people in the room besides the clown. One was the man he had seen leaning out of the window, and the other two were women; one of the women sat on a couch against one wall, knitting, and the other sat in a hard-backed chair in a corner of the room, staring off into nowhere. Bobby had seen that way of staring before.

Though he had been around old people all his life, he suddenly realized that all of these people were old—and that none of them had the cable. The woman

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in the hard-backed chair had the same look of blank contentment on her face that the people at the Home did when they were remembering, but this woman had no wire attached to her skull. In fact, Emily seemed to be the youngest of all of them.

"Randy," Emily said to the clown, "on my way back from Yonkers I sat down on the bus next to Vernon Buckley's son, who was running away from the Albany Memory Home. Ladies and gentlemen, meet Bobby Buckley."

There was silence in the room, and Bobby felt all at once frightened as all eyes fell on him. There was a mixture of looks in those eyes—disbelief, surprise, and, especially on the face of the clown named Randy, a kind of hate. Emily suddenly knelt down and took his shoulders in her hands. "Bobby, it's all right," she said. She stood up and put her arm around his shoulders. "He's a good boy, and I told him he could stay with us for a little while. That's okay with everyone, isn't it?"

There was silence for a moment, and then the man in the T-shirt said, "Emily, he's the one we were going—"

"That's right, Phil. But things are different now. We'll all talk about this later."

The clown, the one Emily had called Randy, said, "I don't like it; I don't like it at all. I don't think you should have acted on your own like this, Emily. Not as far as that kid is concerned, anyway. You know what we agreed on." There was a hard look in his painted eyes.

"I know," said Emily softly. "Like I said, we'll talk about this later."

"Well, I'm going to work," said Randy. "Don't do anything till I get back. I want a full vote in this." He gave Bobby an icy look and turned to the door, lifting a large, floppy green hat from a table. He unlocked the door, opened it, and slammed it hard behind him.

Emily tightened her grip on Bobby's shoulder and smiled grimly. "Bobby," she said, "why don't you go sit on the couch while Phil and Marina and I talk?"

Bobby did as he was told, feeling suddenly cold inside. Emily's tone had changed toward him; she was less like Ruth now and more like a lot of the other old women at the home: pushy, often impatient, preoccupied with their own problems. He sat propped in a corner of the sofa and watched as the two women and the man named Phil huddled in the corner by the window, talking in low voices. The other woman, the one in the straight-backed chair, sat motionless, as she had since Bobby entered the apartment.

He knew he was in trouble. He knew that Emily was not what she had seemed to be on the bus; he had a feeling that she was still not a bad person, though, and his instincts told him to rely on her and maybe get away if he got a chance. The rest of them did not seem so bad, either, except for Randy; the man was a cold and bitter old man.

After a few minutes Emily came and sat down next to him. She seemed more at ease. Bobby looked up at her.

"Where does Randy work?" he asked.

"Randy works on the street, Bobby; he performs in front of people and they throw him money. He just about keeps us alive with the money he makes."

"Did he always do that?"

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"No, Bobby, no; Randy used to work in the circus—in fact, he worked in the circus all his life. He ran away from home when he was twelve years old, and he worked as a clown and a juggler and a roustabout until he was sixty-eight. Then a man, the man who owned the circus at the time, came to him one day and told him he was too old and that he was fired. Just like that. He's a very angry man, Bobby; he's been angry at the world for a long time now."

Bobby saw that Emily's eyes were wet.

"Are you going to hurt me, Emily?"

"No! No, Bobby," she said, taking his hand, "no one here is going to hurt you. Do you—" she hesitated. "Bobby, do you know anything about old people?"

"I've lived with them ever since I can remember. At the Home."

"I don't mean at the Home, Bobby. Do you know the way old people live outside the Home?"

He looked up at her and was silent.

"Bobby," she said softly, taking both of his hands in hers, "old people aren't treated like, well, like real people. When a man gets too old to do his job or work steadily, or when a man or woman gets sick or doesn't move as fast as he or she once did, younger people start to treat them differently. They start to push them away, little by little, in small, silent ways. There is a kind of separation that takes place; a cutting off. We're treated almost like aliens, Bobby, the way little babies are."

Bobby looked at her steadily.

"Your father, Bobby," and here he could see the strange, angry look come over her again, "your father has turned us into aliens. He's made the final scissor cut and chopped us off from the rest of the race.

"Do you see the way we live, Bobby? This whole area of the city is now a slum for old people. We've been herded here by sons and daughters who don't want to see us get old anymore, don't want us there to remind them that this is the same path they're on.

"But there's a choice, of course; there's always a choice. Your father gave us one. What your father does, Bobby, is hook people up with their pasts, so that they can live again the way their sons and daughters live now, before they got old. He lets them go back. And it's not right, Bobby. It encourages people to think of us the way they do, and it makes them start to think that it's all right; that this is the way things should be. What your father has done is hook old people into televisions of their own minds, televisions that play old memories over and over because, people like Vernon Buckley think, there aren't any new memories worth producing. But he's wrong, Bobby; he's *so* wrong."

She was crying now, and Bobby sat helpless beside her.

"Bobby," she said, enfolding him in her arms and hugging him to her breast, "oh, Bobby, we were going to kill you." She held him away from her, the tears streaming down her face. The other two, Phil and Marina, protested and made a move to stop her but Emily told them, "Let me!" and they stayed back. She looked back down at the child.

"When people are pushed to a certain limit," she said slowly, quietly, care-

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fully choosing her words, "when they are denied what they think in good conscience they deserve, they reach a point where they take matters into their own hands. There is a group of us, a group of old people, who decided to do something about what is being done to us. No one will listen. No one in the government will listen to us, because we're not strong enough politically to do anything to them or make them lose their jobs. So, funny as it may sound, we decided to do something so that everyone would have to listen to us.

"We made a plan. We were going to hurt Dr. Vernon Buckley, hurt him very badly for the things he's done to the old. He . . . they . . . would all see that we were a group that had to be listened to.

"I know it sounds crazy, Bobby, but we were going to get into the Albany Memory Home, simply walk in and pretend we were patients, and kill Vernon Buckley's only child. And leave a message from our group, letting everyone know that the elderly would not stand for it any longer." She looked straight into his eyes. "We were really going to do it, Bobby. But that was because we knew we wouldn't have to look you in the eye, or talk to you."

Bobby was shaking, and Emily began to soothe him, rocking him back and forth.

"Bobby," she said, her eyes distant, "the woman in the straight-backed chair over there is named Lisa. She used to be just like any of us; she used to laugh a lot. She liked a good joke, she liked to go to parties and dances. She liked men to tell her she was pretty. She was very pretty when she was younger. She's my sister. When she was just fifty-eight years old she had a bit of trouble—her husband left her and she began to drink a little. She started to talk about how nice things had been the year before, or the year before that, and ten years before that, or, finally, when she was a little girl. She was convinced there was nothing left that was new for her, that the only good things were things that had happened when she was a little girl.

"She went to your father, and he took her into the Albany Home as a test patient. He tried things out on her that he wasn't sure about, and, finally, he turned her back into a little girl. In her mind, she's a little girl all the time now. That was before he started putting cables into old people's heads so they could turn it on or off. Which really doesn't make all that much difference, since most of them leave it on all the time after a while anyway."

She dried her eyes and got off the couch. "Come with me, Bobby, and bring your bag."

Marina moved in front of Emily. "You can't do this," she said. "Randy isn't back. We've got to wait till he gets back to decide what to do."

"I've already decided," Emily said quietly, "and I think you have, too. If we wait for Randy there will only be a fight."

"I'm not so sure we've all made up our minds," Phil said from across the room. He was leaning on the window sill, his arms crossed over his T-shirt, his eyes downcast. "We ought to think about this."

"If you just let him go," Marina said, "what's to keep him from going to the

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police? Don't you think you were pretty stupid telling him the whole thing? Don't you think he'll tell someone —maybe even his father?"

"We could hold him for ransom, get something in the papers," Phil said.

"And how long would we be able to hold off the police?" said Emily. "We talked about all of this a long time ago. You know the right thing to do."

Marina made a faint motion to block their path, but stepped aside and allowed Emily to open the door.

When they reached the bottom of the staircase, Emily took thirty dollars from her purse and gave it to Bobby. "I won't be able to go with you," she said, pressing the money into his palm. "I have to be here when Randy gets back. Otherwise, something bad could happen. You have to realize, Bobby, that none of us, even Randy, are bad people. Things . . . happen sometimes, ideas grow, and sometimes the ideas get out of hand and take over. Can you find your way back to the bus station?"

"I think so," said Bobby tentatively. "I'll have to, I guess. You remind me a lot of Ruth, Emily. Almost too much. Ruth is like that lady upstairs now." He turned to leave.

"Bobby—" called Emily after him.

He turned.

"Bobby, I love you very much."

When Bobby reached the corner to the block with the subway station on it he saw Randy coming toward him. He tried to hide his face, but it was too late. Randy saw him and shouted, and Bobby started to run. He turned into a narrow side street, and glanced sharply back to see that Randy had followed him and had taken something out of his pocket and was aiming it at him.

He was beginning to breathe hard, and the bag was too much to carry, so he dropped it. As he did so, a shot rang out over his head, then another. He ducked into an apartment building with its front door hanging off its hinges; as he ran through the first floor, looking for somewhere to hide or a back stairway, an old man lurched out of a doorway and tried to grab him. The man was babbling incoherently. Bobby wrenched free, and darted to the end of the hallway where there was a stairwell leading down to the next street. When he got outside he looked carefully around but didn't see Randy.

It took him two hours to make his way to the bus terminal, and when he got there it took him a half hour of hiding in the shadows to screw up the courage to buy a ticket and find out when the next bus was leaving for Albany. He was terrified that Randy would make his way there. But Randy never appeared, and eventually he found himself on an Albany-bound bus under cover of night. The McDonald's billboard, he noticed from across the road when they passed it, was lit up at night in red and white.

When he reached the Home it was pitch dark, but he saw immediately that all the lights on the first floor, including those in his father's study, were on, and that a crowd of cars, many of them police cars, jammed the semicircular driveway by the front entrance. He slipped unobtrusively inside the gate and around to the garden. The sliding doors there were closed but not locked, and no one was out on the back grounds

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or terrace as usual to enjoy the cool breeze.

He made his way to Ruth's room, knocked gently on the door, ready to run if anyone answered. No one did. He went quietly inside, closing the door behind him.

She lay as he had left her, the tubes with their slow liquids still plugged into her arms, one side of her body collapsed into death, the glazed look in her eyes. Bobby cried for a long time over her.

Then he made his way to his father's study, pausing for a moment outside the door to listen to the group of tense voices—his father, the police, the press—within, and thinking of what he would tell Old Carl tomorrow or the day after that, whenever Carl came off the cable, about his adventures.

And then he slowly opened the door and went in.

The old man removed the plug of the cable gingerly from the socket in the back of his head and placed it on the table beside him. "So long ago," he thought, "so long ago to remember so clearly." It didn't seem real. He was a very old man, and the images had seemed unreal because they had happened such a long time before and because the time in between had acted to make him remember things as if they had occurred differently. But he knew that what he had just relived had been the way it really had been.

He replaced the cable in the wall box from which he had taken it and closed the lid. His aged, trembling fingers brushed at the accumulated dust on the box and then withdrew. It had been a very long time since anyone had used this machine, or any other like it. A long time. In fact, the old man was the last one to have a socket in the back of his skull. It was only there so that he would never forget.

So long ago.

A smile touched his lips, and slowly, grunting lightly with the effort, he raised himself from his chair and walked the dusty, cobwebbed corridors of what had once been called the Home, and out into the sunlight and away.

He had old friends to meet.■

● If a species is to survive, it simply cannot afford to go around slaughtering its own kind. Intraspecific aggression has to be inhibited and controlled, and the more powerful and savage the prey-killing weapons of a particular species are, the stronger must be the inhibitions about using them to settle disputes with rivals. This is the 'law of the jungle' where territorial and hierarchy disagreements are concerned. Those species that failed to obey this law have long since become extinct.

Desmond Morris

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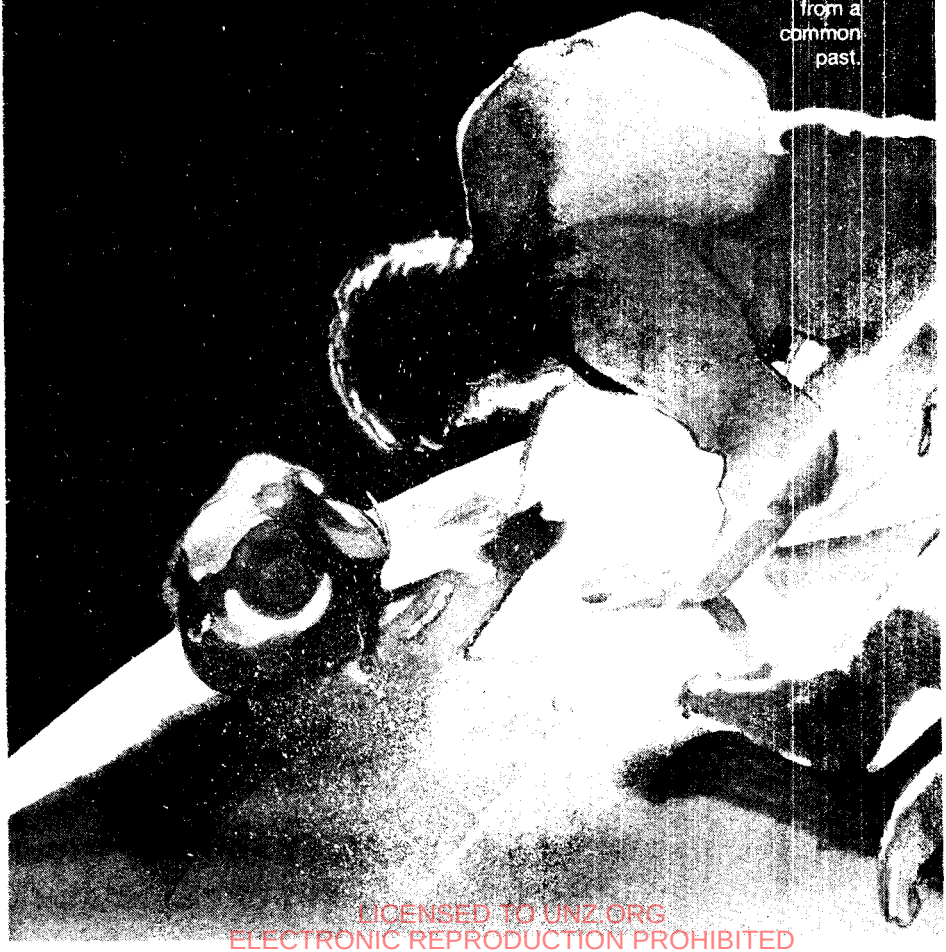
DRAGONSTAR

Conclusion

David Bischoff and
Thomas F. Monteleone

Different evolutionary paths, both leading to intelligence, are likely to lead to fundamentally different forms of intelligence—even if both diverge from a common past.



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SYNOPSIS

The year is 2027 A.D. *On Copernicus Base—the IASA Lunar Colony—***Colonel Phineas Kemp,** *base commander and chief of deep space operations for the IASA, is awakened from sleep and called to the lunar observatory by* **Professor Andre Labaté.** *It is an urgent, top-secret meeting.*

A strange object has been detected passing through the field of view of the observatory's photometer array. From earliest data, the object is travelling in a cometary orbit down the gravity well towards the sun. Professor Labaté *is baffled by the object as he tells Kemp that it is presently passing within the orbit of Jupiter.*

Because of the currently delicate political situation on both the earth and the moon, Kemp *immediately puts a top-secret classification on this information. He considers sending an IASA ship into orbit-intersect course with the object for close-up analysis, realizing that the closest ship for the mission must be one of the IASA mining vessels currently working the asteroid belt.*

The political situation is this: the Russians have allied themselves with the Western nations in space operations—the result being the IASA. The Chinese also have a lunar colony, and an uneasy truce with the rest of the world. The real center of global tension lies with the power structure of the TWC, the Third World Confederation—an alliance of Arabic and African nations which became an extremely powerful force internationally because of their death-grip upon the planet's petroleum resources. Their rise to power and influence, however brief, did allow them to establish a lunar colony called Ramadas Khan. As the twenty-first century wore on, however, and the world's supply of oil became extinct, the TWC lost its power in world affairs. There is nothing more important on their global agenda than to regain their previous position of influence and control upon the world's economy and politics.

Phineas Kemp orders a surveying / prospecting craft (nicknamed a "Snipe") to be dispatched from an IASA mining ship, the Astaroth. *The two man crew of* **Peter Melendez** *and* **"Big Chuck" O'Hara** *guide the small vessel along an intersect course with the approaching object, armed with an arsenal of cameras and analytical instruments. Upon close-approach, they discover that the object is an immense cylindrical spacecraft. Its dimensions are staggering: 320 kilometers in length, 65 kilometers in diameter. It is apparently an alien vessel capable of interstellar flight; it turns on its longitudinal axis, creating artificial gravity on the interior by means of centrifugal force. Colonel Kemp orders the Snipe to touch down on the surface of the alien vessel, and the maneuver triggers defensive mechanisms on the cylinder's superstructure which destroys the Snipe, killing its crew.*

If the alien ship, now titled Artifact One *by Colonel Kemp, contains an alien crew which may be hostile, they make no attempt to respond to the IASA's efforts to initiate communication. Aside from the destruction of the snipe, the alien vessel is silent. All telemetered data from the Snipe's analysis is studied and IASA engineers determine the best*

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ways to overcome Artifact One*'s defenses and possibly enter the ship.*

With the approval of the IASA's joint directors, an expedition on board the deep space probeship Heinlein *is dispatched to intercept* Artifact One *and attempt entry. One member of the crew is* **Rebecca Thalberg,** *a bio-medical specialist, who is aboard against the better judgment of Kemp because he and Thalberg are lovers and he fears for her safety. Also aboard the* Heinlein *is* **Ian Coopersmith,** *a black Englishman and tactical engineer whose specific mission is to neutralize* Artifact One*'s defensive systems, and gain entry into the ship.*

This mission is successful, and while **Lt. Colonel Douglas Fratz** *and* **Lt. Captain Michael Bracken** *stay aboard the ship, the remainder of the crew, a landing party of six, enter* Artifact One *after figuring out the mechanisms which control its airlock system.*

Once inside the alien vessel, they discover an encapsulated world of jungle, forest, rivers, and plateaus—illuminated by a thick rod which hangs weightlessly along the axis of the gigantic cylinder. The flora and terrain appear to be an exact model of the Earth's environment during the Jurassic/Cretaceous Ages. Ian Coopersmith is in charge of the astounded landing party. He places communications officer **Alan Huff** *by the entrance hatch, and leads the others on a short exploratory mission.*

They quickly learn that the alien vessel is filled not only with plant life, but with dinosaurs as well. The crew is astonished to discover various species wandering about the terrain, and while watching a herd of iguanodons feed near the edge of a lagoon, their radio helmets pick up Alan Huff's cries for help. They return just in time to see the crewman torn to pieces by two meat-eating dinosaurs called compsagnathi.

The scent of blood soon attracts larger, more ferocious carnivores, and the landing party is scattered in a panic-filled moment. **Doctor Amos Hagar,** *a popular exobiologist, is consumed by an allosaurus; two other crew members,* **Thomas Valdone** *and* **Doctor Gerald Pohl,** *are killed by two gorgosaurs.*

After witnessing the primitive carnage and death, Coopersmith and Thalberg, the only survivors, escape into the thick forest, since their chance of returning to the entry hatch is thwarted by the presence of predators. They remain hidden until the illuminating rod in the center of the cylinder grows dim, creating an artificial night. Nocturnal-feeding dinosaurs drive them deeper into the primordial forest and they quickly become lost.

Colonel Phineas Kemp, understandably shocked by the massacre of the Heinlein *landing party, orders Mission Commanders Fratz and Bracken to remain onboard their ship and not attempt entry into the alien vessel until a follow-up expedition can join them. He is understandably shaken by what he has witnessed on the expedition cameras, but he clings to the hope that Rebecca Thalberg is still alive.*

He immediately begins organizing a second team to intercept Artifact One *on board the deep space vessel* Goddard, *with Kemp himself as the commander.*

Also at this time, a meeting occurs between a blackmailed Copernicus Base

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director and an intelligence officer of Ramadas Khan, the TWC Lunar Colony. Information concerning Artifact One *is leaked to the Third World Confederation.*

As the Goddard *is prepared for launch, various scientists and engineers are speculating about the immense alien ship, which has now assumed the informal code name* Dragonstar, *since it is a starship filled with "the dragons of Eden." The most popular theory is that the vessel was an alien specimen ship, which visited our solar system approximately 180 million years ago, collecting a vast, representative sample of the flora and fauna of the Jurassic Age. Leaving our system, the theory goes, there must have been an accident which either killed or disabled the crew, or in the least, disabled the main engines. In this way, the* Dragonstar *became trapped in an eccentric, comet-like orbit which takes it around the sun once every 210 years.*

Meanwhile, time passes inside the gigantic, cylindrical ship, and Coopersmith and Thalberg struggle to survive. They have been unable to find their way back to the entrance hatch and spend several "days" wandering through the primeval forest. Coopersmith then suggests that the two of them make their way towards the distant end of the cylinder, where the ship's engines, and possibly its crew-quarters might be located. He reasons that if and when another expedition reaches the alien vessel, the astronauts will eventually investigate the engine-section of the craft. Coopersmith is an adept, resourceful man, whose knowledge of survival tactics keeps him and Thalberg alive. Although Rebecca has always respected Ian, she has never actually liked the man. Now that they are thrown together and must rely upon one another for survival, she finds herself becoming attracted to him. As they move through the ship's interior, reaching a plateau, they sight pyramidal ruins in the distance—something which suggests new variables, heretofore unthought of. Intrigued by the possible evidence of intelligent life in the interior, they strike out in the direction of the ruins. During this passage, Ian and Rebecca, sensing a growing need for comfort and intimacy, become lovers.

The deep space vessel Goddard *arrives at the* Dragonstar *with a crew of thirty experts. One of the* Goddard *team is* **Mikaela Lindstrom,** *a paleontologist to whom Kemp is attracted, despite his feelings of guilt concerning Rebecca Thalberg. The* Goddard *crew enters the alien ship, and sets up a base camp around the entrance hatch, using a force-field fence to keep any predatory dinosaurs at bay. Lindstrom begins a detailed study of the creatures, while the crew's engineers begin placing outrigger impulse engines on the* Dragonstar *with which they will break the immense cylinder from its cometary orbit and guide it into a stable L-5 orbit near the Earth. From that position, scientists can study the vessel at their leisure, and the IASA can marshal heavier forces to protect the vessel from the Chinese and the TWC.*

There is one problem with this strategy, however. The TWC is already at work with their own plans. A "sleeper" agent, **Ross Canter,** *has managed to be placed on the* Goddard *mission, and*

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at the appropriate time, Canter sabotages the expedition's communication gear, cutting it off from all contact with Copernicus Base.

Almost simultaneously, a group of TWC terrorists, led by **Marcus Jashad,** *hijacks an IASA mining vessel, the* Andromache, *while it is parked in lunar orbit. The TWC eliminate the mining ship's crew, except for its captain,* **Francis Welsh.**

Filled with one hundred trained guerilla fighters, the Andromache *heads out to intercept the* Dragonstar. *Control of the alien vessel, and its secrets of advanced technology, will once again make the TWC the controlling force in world affairs.*

Inside the Dragonstar, *Coopersmith and Thalberg are getting to become more comfortable with one another, and are learning how to survive in the Jurassic world. They manage to avoid most of the dangerous creatures by studying their habits. Once, however, while crossing a flat, open piece of terrain, they encounter a chasmosaur, which charges them like a rampaging rhino. Coopersmith raises his .44 Magnum, but trips over a rock before he can fire. Rebecca Thalberg moves quickly, picking up the weapon, and pumps several rounds into the well-armored beast, finally dropping it.*

Eventually, the pair reach the pyramidal ruins, discovering hieroglyphs in the cut stones which depict lizard-like beings standing on two legs. After climbing to the top of one of the pyramids, they discover that they are not far from the end of the cylinder.

But more surprising is a sight which is not more than several kilometers ahead of them: an immense wall which seems to stretch all the way around the interior circumference of the ship. It is an artificially constructed barrier which seems designed to separate the rear section of the cylinder from the rest of the interior.

Coopersmith and Thalberg spend the night in the ruins, and make their way towards the wall the following morning. They are delayed when they encounter a Tyrannosaurus rex lying in a torpor, digesting a large meal which has distended its belly. The monster sees them and attempts to rise, using its forelimbs to hold its head and shoulders steady, while its powerful hindlegs dig for purchase to push itself upright. It is obvious that Ian's handgun will not kill the beast, but he thinks quickly, and carefully fires several explosive slugs into one of the beast's forelimbs, shattering the bone. The Tyrannosaurus loses its balance and falls, floundering just long enough for Coopersmith and Thalberg to escape.

Although exhausted and drained from the panicked flight, they race onward, finally reaching the wall. It is composed of wood, stone, and some kind of crumbling mortar-material. There are a series of towers spaced evenly along the wall and from the top of the nearest tower, a creature with the flame of intelligence gleaming in its eyes leans over to regard them. It is pointing a cross-bow at them.

Rebecca notices that the creature is wearing some kind of green shirt, and an idea strikes her. She suggests that she and Ian remove their clothes to show the creature that they too are intelligent

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creatures and that they are unarmed and have no hostile intentions.

This action excites the creature greatly, but at least it does not fire at them with its weapon. It disappears from the ramparts, and several minutes pass before a gate opens in the wall and a party of armed creatures emerges. They appear to be evolved from the two-legged dinosaurs called Saurornithoides. *Slightly more than 2.5 meters tall, they are fairly smooth-skinned with vestigial scaling. They stand totally erect, possess definite shoulder and arm musculature, have three-fingered hands and opposable thumbs. Their necks are thick and longish, supporting a bird-like head. Their faces are pointed, but there is no beak, and their large green eyes are positioned stereoscopically under defined brow ridges. Their skulls are large and possess sizable brain capacity.*

Both the humans and the saurians stare at each other curiously for a moment, before the leader of the saurian party indicates that Ian and Rebecca replace their clothing. They do so, to the obvious excitement of the saurians. One of them strides forward in an effort to touch Coopersmith and is forcibly restrained by the other saurians. During this action, the saurian's own shirt is torn and falls from his body. This seems to trigger an automatic response in the other saurians and they immediately bludgeon their bare companion senseless.

Coopersmith and Thalberg are then escorted into a primitive "city" beyond the great wall. As they pass among simple buildings, Ian and Rebecca notice the absence of high technology and evidence which suggests that the most advanced of the saurians' sciences may be biological. They are taken to a large structure which resembles a prison in that it is filled with small cells. Coopersmith is placed in a small compartment that is occupied by another saurian who appears to be in a dull trance. It awakens and ignores Coopersmith, acting quite docile, as it goes to the front of the cell and calls out. A "jailer" appears, gives the saurian a new shirt, and releases it.

Although he is confused by the behavior of the saurians, Ian wonders if it has anything to do with a lack of a counterpart to the human limbic system of the brain. Perhaps the dominant R-complex of the saurian brain causes the members of the society to undergo cyclic phases of Jekyll-Hyde behavior?

In the meantime, the Goddard *expedition has been conducting search forays into the interior of the* Dragonstar, *and on one of them, Kemp and Lindstrom discover a discarded rations pack and a corroded communications unit—evidence that there was at least one survivor of the first expedition. When Colonel Kemp returns to the base camp, he learns that their link with Copernicus Base has been sabotaged, and now fears that there may be some attempt by the Chinese or the TWC to interfere with their plans for the giant alien ship.*

After placing his men on alert, Kemp, Lindstrom, and an ornithopter pilot, **Zabriski,** *take off along a longitudinal course to search for any sign of the first team survivors. Eventually, they encounter the wall at the far end of the cylinder, and behind it, the structures*

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of a primitive city, and its saurian inhabitants.

CONCLUSION

CHAPTER FIFTEEN

"Hello, Phineas," Rebecca Thalberg said. "We've been expecting you. That's why we suggested that the saurians bring you here."

She was sitting on the floor opposite Ian Coopersmith. All about them, the floor was littered with charts and pictographs: alien symbols. Coopersmith gazed up and grinned at the new arrivals. "Afternoon, Colonel. Have we got an alien culture for *you*."

"Shit on alien cultures," Kemp said, striding forward and hauling Becky up from her crouch. "I'm just glad to see you two *alive*." He embraced Becky fervently. She responded only as a sister might respond to a long-lost brother. There was no passion in the hug, no ardor.

Puzzled, he released her and looked down to Coopersmith.

Coopersmith whistled softly to himself as he resumed his study of the manuscripts.

Emotions twisted and roiled inside of Kemp. Joy soured to jealousy, relief to anxiety. He turned to Thalberg, and she confronted his searching gaze with an honest, open expression that said, *Yes, Phineas. Things have changed.*

He stepped back a moment, and gazed about the hall as Mikaela Lindstrom stooped down beside Ian Coopersmith and began to babble excited questions. A dozen armed saurians stood guard in various places along the hall. Five saurians sat nearby, dressed in flowing, colorful robes. They spoke their high-pitched chitter to one another, occasionally turning toward the party of humans and simply staring with reptilian astonishment.

Phineas Kemp breathed deeply twice, and let all his emotions go with his final exhalation. He carefully fitted on his professional veneer, and he turned to Nordman. "Raise Michaels and Zabriski on the comm. Make sure they're still okay."

"Check, Colonel."

They'd landed near the city, and immediately been surrounded by the saurians. Lindstrom had almost burst with ecstasy. "These must be *Saurornithoides*, Phineas," she'd cried. "We're looking at intelligent creatures who might very well have been the big wheels on Earth, if they'd had the chance. Intelligent dinosaurs, Phineas. Imagine!"

After a period of extreme caution on the humans' part, as the saurians executed various odd dances and capers which appeared to be some kind of proclamation of peaceful intentions, Kemp had allowed them to lead them, leaving Michaels and the pilot to guard the ornithopter and serve as relay for communications between them and the base.

The comm unit squawked, and a voice said, "Roger. Zabriski here. We've got about a hundred of the things milling about, fifty yards away. Astonished, I'd say. Treating us as though we're gods."

"Get that, Colonel?"

"Got it." He turned back to face Becky. "The question is, will they let us go?"

"I don't think there will be any prob-

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lem with that, Phineas, as long as we make our intentions clear, and promise to come back. At first they didn't know what to make of us. But once their priest-class got hold of us . . . well, we started getting treated like royalty. I've managed to figure out a few words and gestures in the days we've been here. Ian's done a lot better than I have, haven't you, Ian?"

Because he's a reptile too. A snake in the grass, Kemp thought, but as soon as he realized the irrational nature of that thought, that feeling, he suppressed it. "So. We've much to talk about, then." Not a quiver or a shake to his voice. But Phineas Kemp found no pleasure, no self-righteousness in his display of pride.

"Yes," Ian Coopersmith said. He rose. He was wearing a robe similar to the ones that the lizard-priests wore.

"Nice outfits, huh?" Becky said, spreading her own and performing a mock curtsey. The robe was like a piece of a rainbow. "Needless to say, our suits were a trifle dirty and ragged after our expedition here." Her hair was newly washed. Soft and smooth, shining in the light from the window. On a very deep level, Kemp knew that he would never be able to touch it the way he would like to again.

Even though he hadn't lost her to the dinosaurs, he'd lost her.

He glanced over at Mikaela, and took some comfort in her presence. He could hear his father's voice say, *You've become an old softie, Phineas. The women have finally got you right where they want you, one hand on the gonads, one on your heart. Say goodbye to your dignity.*

And Phineas thought, *Yeah. You're right, Dad. Now shut up.*

Ian Coopersmith stood, brushing off his hands. "So, we've got lots of time. What do you want to hear first? How we got here, or exactly what we've found."

"In any order you care to give it," Kemp said. "Only we really don't have that much time, Ian." He looked at him sternly. "Our problems aren't over yet. Looks like the TWC is going to make a military play for this vessel. When, we don't know, but we have to be prepared. There's no one between them and us. We're on our own." He told them about the sabotage.

"Damn," Ian said. "And I thought we were home free."

"Home's a long way away, Ian," Kemp said resignedly. "And there are some big obstacles in our path."

CHAPTER SIXTEEN

Captain Francis Welsh was sitting in his quarters of the *Andromache,* drinking his fourth beer of the morning, when the TWC expeditionary leader entered.

" 'Lo, Jashad," Welsh called cheerily, holding up an unopened bulb of beer. "Have yourself a cocktail."

"I am sorry, my friend. My religion forbids the consumption of alcoholic beverages." White teeth showed through a dark beard.

"Oh yeah. Well then, smoke a joint, then." Blearily Welsh leaned over and procured a recently rolled marijuana cigarette for his captor. The man called Jashad accepted it graciously and lit it with his own lighter.

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"Everyone has their weaknesses," the handsome, fortyish man explained, blowing out his words with an exhalation of smoke.

"Everybody's got their drugs, you mean." Welsh said, laughing. He took a gulp of his beer. "Even if they only manufacture it for themselves in their brains." He coughed. "Yeah. I can see the shelf of the stuff in the average TWC peon brain. A gallon of the elixir of stupidity. A phial of arrogance. A beaker of misinformation. And a whole crock of bullshit you fling for propaganda!"

Jashad laughed heartily. "You misunderstand us, Captain Welsh."

"Really?" He crumpled his beer bulb container, tossed it in the trash receptacle and reached for another full one. "I understand you killed a lot of people to get my ship. A lot of my friends. I understand that you would have killed *me* too, if you didn't think I might be useful in your mission . . . whatever the shit *that* might be." Welsh snorted. "What are you here for? Another game of chess? Never thought you'd find an infidel who could actually beat you once in a while, did you, Jashad?"

"I admit, I do enjoy our games." He took another casual draw from the cigarette, holding it in his lungs for only a second or two. "But I have not come here to engage in that activity."

"Yeah, well, like I told you, I'm not going to help you navigate, or anything, I swear to God."

"That's not necessary, Captain Welsh. Our own men have proved most effective in that capacity. And we have nearly reached our destination."

"So now you're going to kill me, huh? Can I finish my beer first?"

"Please, Captain Welsh. You are too bitter. Your company has been most welcome on this trip. I have grown most fond of you. No, you may yet be of service. And besides, even if you had no potential for service, I would still not have you killed. You have proved yourself harmless enough, if provided with"— He pointed to the trash can full of empty beer bulbs —"enough cocktails."

"I have *that* to thank you for, anyway," Welsh admitted grudgingly.

"You were the one with sufficient supplies," said Jashad. "We merely allowed you . . . access." He sat down in a chair, which was bolted to the floor. "No, I am here, Captain Welsh, neither to play chess with you nor to kill you."

"Cheers then."

"I'm here to try to explain."

Welsh almost spit out his beer. "Explain! What good is that going to do you, Jashad! Explain *what*, anyway?"

"Exactly why the drastic measures we've taken have been necessary. Captain Welsh, you may not be aware of this, but the fate of the world lies in the balance now."

Welsh listened to the story of *Artifact One* with something approaching disbelief. "Holy shit," he said, finally. "No wonder you folks want it. You want to know about its stardrive, so that all the star colonists will be good little Moslems."

"You are being simplistic, Captain. We are mostly concerned with the present balance of power on Earth. Already, the other forces of the world have outstripped our collective nations not only

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in outer space accomplishments, but in affairs terrestrial. We do not wish to become the leaders of the world, Captain. We merely wish a balance of power. We wish for our various cultures, beliefs and world-views to have an influence on the destiny of mankind. We wish for the children we bring into the world to have a *place* in that world. We wish, in short, for an identity. As holders of the keys to the universe, perhaps we might find that identity, Captain. We regret our tactics. They are all we know. Besides, what *other* tactics might we use to obtain that which we *need* not only to survive, but to maintain our self-esteem, our integrity. Too long have we suffered. We have to take these measures, can't you see?"

"And so, to maintain all that shit, you've murdered the crew of this ship and are about to slaughter our people who've taken over what you call *Artifact One*."

"Only if that is necessary, Captain."

"In other words, if they don't surrender upon demand. Which you bloody well know isn't very likely."

"We don't want to kill them, Captain," said Jashad. "And we doubt that we can persuade them to give up. Ah. Perhaps if you explained the situation to them, they might better understand."

"Up yours, Jashad. I told you, no go. Kill me first."

Jashad sighed heavily. He stood and thumbed the door control.

Welsh stiffened, expecting his death to enter.

"Gentlemen, if you will!" Jashad called.

Two men entered, holding more bulbs of beer. They set them down beside Welsh, then departed.

Jashad made a mock-Islam bow to Welsh. "Drink up, friend Welsh. I want to beat you in this afternoon's game of chess."

He left.

Mumbling to himself, Captain Francis Welsh popped another top.

CHAPTER SEVENTEEN

". . . and so we took our clothes off," Becky said, lounging casually on a mound of leaf-stuffed pillows.

Kemp choked on his strong, lukewarm tea. "What did you do that for?" He looked over to Ian Coopersmith, sitting with a fat smug grin on his face. He had to hold back his irrational feelings of jealousy that still flooded him at the thought of Coopersmith and Becky together. Even his warm feelings for Mikaela provided scant comfort in this situation.

"It was Becky's suggestion," Coopersmith said, "and quite a brilliant one, I must say."

"Why, Becky? To show you were discarding your weapons?"

"No. Principally to show the saurian that we were intelligent beings, that the stuff we wore *wasn't* skin. As it turned out, Ian had the common sense later on to realize that we'd better put the clothes back on, and *fast*, or they'd club us senseless."

Kemp blinked. "But why? I don't understand. Surely all this around us—" He swept his hands around, indicating the room they sat in with its rugs and its intricate mosaics, the scattered man-

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uscripts on the floor, the windows offering views of other buildings. "Surely this suggests rational minds."

"You forget, Phineas," Mikaela said, "that we're not dealing here with human beings. The rationality of these creatures is most likely grounded on an entirely different set of circumstances, to say nothing of environment and bio-social necessities."

Phineas shook his head, confused. "So continue, Coopersmith. What happened then?"

"Well, they dragged us to what we thought was a prison and locked us in separate cubicles. Previously, we'd seen really bizarre behavior. One of the saurians accidentally got his shirt torn off—that's all the middle class of the society wears, you know—and the others just clubbed him senseless, as though it was an automatic response. They're evidently not exactly gentle with one another here in Saurian Land. So they stuck me in my cubicle, manacled me—"

"Me too," Becky said, "only they clubbed the previous occupant of my cell, who'd been in a real lather."

"Right. But the occupant of my cell was asleep in the corner."

"Pleasant," Kemp said, wishing they could go outside. The reptilian musk of this place was getting to him.

"Yes. But you know, when this particular chap woke up, all he seemed to do was scream to get out. And they *let* him out. All calm and civilized as you please when he exited. Well, to make a short story shorter, they kept us there for about what we reckoned for a day. They watched us closely. They fed us some *awful* slop, but it was food. Then they let us out and brought us here. Near as I can reckon these creatures you see watching us, in the robes, are the upper class—the priests. Or the philosopher-kings, if you will. Plato would love it here. Evidently, they've got three classes, just like in his *Republic*. They've got a warrior-class, a worker class"— he nodded over to the guards— "a sample of which you see yonder. And the priests, who serve as religious and community organizers as well as governors. But this is not a political system, Kemp. It's more a *biological* system. In the days that we've been here, Becky and I have been pretty much able to sketch out the scope of this civilization. Of course there are details and nuances which we'll *never* be able to understand, unless of course we actually know what it's like to *be* a saurian. We think, though, we've got the basis."

Mikaela said, "What about families? They wouldn't have families, would they? Being reptiles."

"You put your finger on one of the keys," Becky said.

"Let me guess the other one," Mikaela interrupted with great excitement. "They probably don't have any limbic system in their brains. Just the R-complex, blending into their version of the neo-cortex."

Becky raised an eyebrow at Ian. "It took us *days*."

Ian snorted playfully. "Yes, well she's a paleontologist, isn't she. We're just laymen on that subject!"

"Hey! Wait a moment," Kemp said with irritation. "You're leaving *this* layman way behind. Fill me in."

"Okay," Mikaela said. She turned

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to Coopersmith and Thalberg. "Do you mind?"

"You're the authority," said Coopersmith, smiling.

"Deep down, we've still got a reptilian heritage," Mikaela said. "Mammals are descended from reptiles. The part of the human brain which is still reptilian is a group of massive ganglia. The corpus striatum, the globus pallidus—"

"You don't have to get so technical. Just the essentials, okay?" Kemp said.

"Ah. Very well. Essentially, there are three parts of the human brain. From bottom up, there is the R-Complex, which plays a vital part in our instincts. Aggression, ritual, and territoriality—these are all things that are controlled by the serpent inside of us. Including sexual display, I might add. Now, atop this, with an entirely different chemical system, is the limbic system, our mammalian heritage. This might be called the seat of our emotions, our tendency to form social groups, to be angry, to despair, to love. To nurture and to continue the species and the culture. Quite a bit more complex than our reptilian natures. Following that, is the neo-cortex, which is the home of reason. This is where we think. Again, an entirely separate system. Current psychotherapeutic thought is that if you can get all these systems into harmony, you've got a well-adjusted human being. But if any of them gets out of control—which they often do—you've got trouble." She turned to Coopersmith and Thalberg. "I presume that you've supposed this by the behavior of the saurians."

"Yes," Coopersmith said. "From what we can tell, the system is this. The warrior class do not actually live within these walls. Apparently, whatever serves for their version of a neo-cortex is only used occasionally, most likely in times of danger of the species. How they know about danger, I've no idea. Some kind of ESP? God knows. At any rate, the others don't want them around anyway. Too dangerous. Now, the middle-class, the *workers,* are a pretty strange bunch. In their normal, shall we say, 'waking' stage, they are perfectly rational individuals, easily organized by the leaders and by traditional social dictates. In short, good citizens. The good citizens wear that little shirt, for a very good reason. You see, they've not developed the same kind of sleep system we have. When their neo-cortex—or the analogue for that in their brain—turns off to do its data storage and processing, this allows the R-Complex to take over. Since the actual body and brain need only a couple of hours to actually sleep, these middle-classers are essentially schizoid beings. You never know if your neighbor is going to kill and eat you. Not quite so drastic, but harmful. Jekyll and Hyde, don't you know? So, the system is simple. From infancy, just before the individual realizes he's 'falling asleep' he is trained to tear off his or her shirt, thus signalling males to get the individual in check if he's on the loose. Generally, though, when the saurians get tired, they check into one of the cubicles we were thrown into. When mating time comes, they just throw a male and a female in the same cubicle together just before their bedtime."

"What about the philosopher-kings?" Kemp wanted to know.

"Evolution at work. Apparently, at

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some stage in evolution, lizards who were better integrated began to emerge. These became the organizers, the leaders, the thinkers. Through intellect, these few began to organize a viable society. Apparently, it's quite a history. Absolutely incredible. For example, you might have noticed ruins on the way here."

"Yes, we did," Kemp said.

"Right. Relics of the civilization before the leaders got together and said, 'Hey. Let's build a wall to keep the bad critters that want to eat us *out*.' Voilà. The great wall. Towers. Guards. Systems of defense that include some really marvelous manipulations of symbiosis. I could go on for hours. Specially bred reptiles raised for the sole purpose of being *weapons*. Then there are the watchbeasts, a species of carnivore which they've just recently been developing to patrol the perimeter of the Wall."

"Wait a moment, now. You say there's no family. How are the creatures raised?" Kemp asked.

"That was one of the areas that I explored," Becky said. "Apparently, at the right point of pregnancy, the female is escorted outside the walls, oh, a kilometer or so, to hot springs or mud flats warm enough to lay her eggs in. Then she goes back to normal life in society. The eggs hatch. The ones that haven't been found by predators and eaten, anyway. Still, the numbers of hatchlings must be impressive. The more intelligent ones manage to survive and find their way back to civilization, where they are welcomed with much ritual. A board of review composed of the priest-kings decide exactly what class of being these youngsters are. The warriors are given rigid instruction —almost behaviorally conditioned, as a matter of fact—and then kicked back out into the jungle. The ones judged sufficiently advanced to belong to the workers are trained, and then allowed to join society. Very rarely, a new priest-king candidate arrives, which is the occasion for great joy. The system is by no means smooth, or so well divided. For example, there are stories of the occasional supposed philosopher who 'falls asleep' and commits some dreadful reptilian act. And there are those priest-kings whose R-complex is used to further their own political ends. Apparently, this can be a kind of Machiavellian heaven. There are whole intricate structures of deceit. Simply, sometimes it's a part of everyday life."

"I can imagine," said Mikaela. "With no family network to work within, each individual owes allegiance only to the social fabric itself—and themselves."

"Gaming appears to be a way of life, here," Becky said. "To say nothing of ritual. *Unbelievable*. Incredibly complicated. You know, there's even a ritual method of smashing a rogue saurian's head. One of the great jokes you can play on a friend, for example, is to trick him into 'falling asleep' outside of a cubicle. If you can get a pair of handcuffs on him so that he can't do any harm, it's great sport."

"And quite embarrassing for the friend when he wakes up, I dare say," Kemp commented. He licked his lips, and studied the two of them. "It looks like you've been enjoying yourselves. I'm sorry to break up the party with my

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bad news." He nodded at their dress. "I can imagine that the philosopher-kings or whoever they are were pretty excited to find that you didn't have a reptilian stage."

"Yes. They identify with us. That's why we've been allowed such access to their records, their whole culture. They trust us, Phineas."

"Yes, but as you say, they may well be a deceitful lot. How do we know we can trust them?" Kemp said, glancing at the group of priests, still involved in their heated discussion.

"Well, my friend, if you're correct about the TWC being on their way, let's hope that you can make friends with them." Ian Coopersmith said, "We're going to need all the help we can get. Oh, and Phineas—"

Kemp wished the man wouldn't be so familiar with him. The situation was grating on him.

"They took me close to the wall—the end of this world. They took me on a tour of what seemed a rather special temple." Ian Coopersmith adjusted his posture, leaning slightly more forward with each sentence, as though for emphasis. "It appeared to be a repository for all their most sacred documents and records. I would imagine there are more of these buildings scattered around the circumference of their civilization, but any rate, in *this* one, I was shown their equivalent of books, art, sculpture, and incredibly detailed tapestries which depict their history, their mythology, and their theology. And in going through their records, it appears to me that the priests—at least some time in their history, and maybe even to this day—have been inside the alien crew-section of this ship."

"You mean they've been *beyond* this end of the cylinder?" Kemp leaned forward, trying to mask his interest and seriousness, just in case any of the priests had learned to read human mannerisms.

"Yes, I think so. There are indications that the priests are aware of . . . I guess you would call them Beings . . . or *gods*, who 'created' their world. The pictographic tapestries show lots of primitive creation-myth scenarios that back this up. They also appear to have a messianic myth that—"

"That says the gods will be coming *back* someday," said Mikaela, cutting him off.

Kemp looked at her, unable to hide his surprise. Coopersmith and Becky smiled lightly.

"That's right," said Ian. "And guess who I think *they* think these God-Creators are?"

Kemp shook his head. "This is incredible. Are you sure, Ian?"

"Of course, I'm not *sure*, but there is a lot of evidence which points to this, and I'm no trained archeologist. I think it would be wise to let Doctor Lindstrom have a look at their depositories."

"Yes, I'd love to!"

"Just exactly how well are you able to communicate with them?" asked Kemp.

Ian shrugged. "Not much really. I started out by noticing that their numbering system is based on the number eight—to be expected since they have eight digits on their hands, right?—and I tried to establish some of their letter symbols and number signs by describing

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some basic mathematical concepts—you know, geometric formulae, good old pi and the circumference of the circle, that sort of thing . . ."

"And did it work?" asked Kemp.

"Yes, after a lot of trial and error, of course. The priests finally summoned some of their 'scientists' and 'professors', I suppose you could call them." Ian laughed gently. "I think the personality of the true scientist might be a constant of the universe. Phineas, you should have seen them, they were like children playing with a new toy, trying to communicate with me! We did establish some ground rules and I am familiarizing myself with their alphabet little by little."

"You're actually making progress?" asked Mikaela.

"Very little, actually, but it's a start. I think we're going to need a team of linguists in here to do the job right."

"That will be some time off, I'm afraid," said Phineas. "What about this 'divine' status which has been bestowed upon us?"

"Yes, that *is* a delicate situation, isn't it? I don't know how to play it, honestly. I think we will have to just take it slowly and carefully. But there is more to their mythology, you know."

"No, of course we don't know . . . what do you mean?"

Ian smiled. "The similarities to some of our myths are striking, really, when you think about it . . . and I suppose it says something about sentient life's need to explain things, and its basic need for a . . . a *morality*, I guess, is the proper term for it. At any rate, they've been looking forward to our arrival for a long time."

"How do you know they might not be looking forward to the arrival of the TWC representatives as well!" Kemp said.

"I would imagine, Phineas, that *that* depends entirely on how the TWC comports itself in the situation." He shook his head sorrowfully. "In this kind of situation, they are not known to behave themselves very well, are they?"

Later that afternoon, Kemp and Lindstrom accompanied Ian, Rebecca, and a saurian representative on a tour of the Temple that Ian had mentioned. Ian Coopersmith pointed out some of the artifacts and records that had led him to his fantastic set of assumptions. Doctor Lindstrom was surprised at how many of Coopersmith's notions seemed valid in light of the saurians' cultural artifacts. Phineas was surprised to discover such a rich culture amongst the descendants of dinosaurs, although his mind was preoccupied with other problems.

When they returned to the main hall of the Temple, Kemp summoned Zabriski and his crew by radio, guiding them in to their present location with a homing beacon. Then he reported back to Captain Marshall a detailed summary of what he had uncovered. Following a discussion with Ian Coopersmith, Kemp decided to send the ornithopter to pick up Doctor Jakes and some of his men so that a more immediate investigation of the saurians' world could be initiated. More exactly, Ian felt that he could coax the priests into showing them how to gain access to the alien crew section of the ship.

Marshall replied that the scanners on board the *Goddard* and *Heinlein* had so

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far detected nothing within range, and that the outrigger engines would presently begin deceleration of the *Dragonstar* as it approached the Earth-Moon neighborhood. Estimated arrival in L-5 orbit was still two and half weeks away, but considering the velocity of the alien ship, and the time needed to alter its course, gross course corrections and deceleration was already beginning.

The ornithopter departed, leaving Kemp, Mikaela, and the two other astronauts with Ian and Rebecca. Later that evening they were treated to the equivalent of a "state dinner," which many members of the ruling caste of saurians attended. A good time was had by all, despite the problems in communication. Up to that point, Phineas had no opportunity to speak with Becky privately, and from the way she conducted herself around Coopersmith, he was not certain that he *wanted* to talk to her. There were simply too many other pressing problems for him to be concerned with what she and Coopersmith had done for entertainment during their long weeks in the Jurassic forests.

The next two days passed quickly as the ornithopter made several flights from the Barrier to the base camp and back. Ian Coopersmith continued to establish a more meaningful system of communicating with the cooperative saurians, while Jakes and his men investigated the cylinder-end of the ship as discreetly as possible. The general population regarded the crew of astronauts and scientists with the utmost respect and a degree of awe, which made the initial phase of the investigation as easy as could be expected.

The walled-in civilization had been established quite a few centuries back, Mikaela Lindstrom surmised, since it was the only way the saurians' ancestors could cope with the savage realities of the Jurassic world. The system of guard towers and maintenance crews which were constantly patrolling the great wall was a revered tradition, and well it should be, since it represented the very survival of their primitive society. The society itself was largely agrarian, stemming from the omnivorous habits of their ancestors. There were urban centers evenly spaced about the interior circumference, which served as places of economic and cultural exchange.

As the *Dragonstar* coasted inexorably closer to the Earth and Moon, Kemp became lulled into a false sense of security, and he was beginning to feel that the sabotage incident had been an isolated event—a symbolic gesture, though futile, on the part of the TWC. He became caught up in the excitement of Coopersmith, Lindstrom, and Jakes as they continued to discover more and more about the fascinating history of the saurians. Perhaps that was the principal reason why he did not act more decisively when he received a transmission from Captain Marshall back at the base camp that the *Goddard's* scanners had detected an IASA ore-ship approaching.

EIGHTEEN

"Are you certain it's on intersect?" asked Phineas as he spoke to his second-in-command by radio.

"Yes, Colonel. Commander Fratz has been tracking it since the scanners

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first picked it up. At first he thought we might just be passing through shipping lanes, but there's no denying it now. It's coming in for an intersect." Marshall looked up from the headquarters intercom at Commander Bracken and Ross Canter, one of the flight engineers, who had volunteered to remain as part of the skeleton crew at base camp.

"It's possible that Copernicus has diverted it from its course to investigate our radio silence," said Kemp. "How's the work going on the communications problem?"

"No luck, so far, sir."

"What's the ETA on that ore-ship?"

"At present velocity I would estimate within the hour," said Marshall, watching Commander Bracken nod his confirmation.

"I want you to keep me informed on the status of that ship, Captain. Secure the main entry hatch and alert your men to be ready for anything. I'm coming back to the camp by 'thopter as soon as possible. Carry on . . . Kemp out."

The intercom radio clicked off and Marshall looked over to the two men in headquarters office. "You two heard the man. What do you think?"

Bracken shook his head. "I don't like it, Captain. I can't put my finger on it, but something doesn't *feel* right to me."

"I think we should just play it by ear," said Canter. "The colonel has no way of knowing what's going on. I, for one, think it's quite natural to assume that Copernicus has sent that ore-ship out here to investigate. I don't think we have anything to worry about."

Marshall nodded slowly. "Well, I hope you're right, Canter. We can't afford any mess-ups at this stage of the game."

"Captain, I'm supposed to be relieving Fratz on the *Goddard* bridge. I think it's time for me to get going," said Bracken.

"I'll go with you," said Canter. "See if I can help the crew that's working in the service module."

Marshall nodded and sat down behind his work-table. "All right, keep me informed. I don't want Kemp calling back here and me not have anything to tell him."

Canter and Bracken chuckled at the small joke, and left the room. They walked to the entry hatch, and descended down the ladder to the airlock, where they suited up for EVA to the *Goddard*. Once on board the ship, Bracken headed for the bridge and Canter made his way down the main corridor to the service module. The ship was deserted, aside from two of Jakes's men working on the damaged communications equipment and Bracken at the command console. It's going to be easier than I figured, he thought, as he paused outside the entrance to the module. Taking over the base camp would be a simple matter with the bulk of the *Goddard* crew at the other end of the cylinder, but Canter realized that controlling the base camp would be of little help to them. If Jakes succeeded in gaining access to the control-section of the *Dragonstar*, Kemp would still be in the driver's seat, quite literally.

Canter needed a contingency plan. He only had an hour or so before the ore-ship rendezvous, so he would be forced to work quickly.

Walking back to the airlock, Canter

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climbed into his EVA suit, and radioed Bracken on the bridge. "Commander, this is Doctor Canter . . . I'm getting an unstable reading on one of the outriggers. I'm taking one of the work-scooters down to the aft end and check it out."

"Okay, Doctor," said Bracken. "Be careful out there . . . I don't have anybody to back you up if you get yourself in a jam."

"Affirmative, Commander. I'll check in by intercom if I find anything interesting."

Canter flicked off his helmet mike and cycled the airlock. With the shining expanse of the alien ship below him, he coasted over to one of the work-scooters, little more than a frame, cockpit, and naked engine, climbed aboard. Accelerating away from the *Goddard-Heinlein,* Canter headed down the length of the immense cylinder toward the stern. From Jakes's most recent reports, the saurian wall was located approximately 40 klicks from the engines. He would have to estimate distances since he did not have the time to get a precise location. He would also be limited to placement of an entry hatch in the side of the cylinder.

That, in fact, was the key to his plan—there would *have* to be another entry hatch near the aft-end.

The little scooter picked up speed and he was topping 400 kph when he started to decelerate, finally slowing to a crawl, and dropping his altitude to 10 meters above the surface of the hull. He had the sensation of flying in a hovercraft across a vast desert plain. It was difficult to believe that you were actually flying across the surface of a *ship*. Without instruments to give him a precise amount of distance covered, Canter was forced to guesstimate when he was within 40 kilometers of the end of the cylinder, which he did, before scanning the surface for the distinctive markings that indicated an outerhull airlock.

Ten minutes later he found one. He was not sure of its exact position, but it would have to be sufficient, since he was running out of time. Using the razer-torch on the scooter's tool-rack, he burned through the plate which housed the lock's manual over-ride panel, then carefully opened the outer-lock door. To mark its location, he took an electronic work-flare from the scooter's rack and attached it magnetically to the hull by the lock. Its low-frequency beeper would serve as a beacon to anyone trying to locate the lock.

As he climbed back aboard the scooter, he checked his chronometer—less than twenty minutes before the ore-ship would arrive, at the latest. He would have to hurry. He fired the scooter's engine, headed back toward the *Goddard-Heinlein* link-up, and radioed-in to Bracken.

"Commander, this is Doctor Canter . . . I've located the problem on one of the impulse engines. I can rectify, but I will be tied up for about another hour or so. Do you have any problem with that timetable?"

"Affirmative, Doctor. ETA with the ore-ship is coming up soon. I don't know if you should be out there while all that's going on."

"I don't *want* to be out here, Commander, but if I don't get this engine stabilized, it's going to fail sooner or later. I'd rather save us the trouble of

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course-correcting for the loss of directional thrust when it goes. . . ."

"All right, Doctor. I guess you know what you're doing, but be careful. Bracken out."

Canter smiled as the radio went dead. The scooter accelerated until he was at top speed, holding it for a few minutes, before reversing thrust and slowing down for rendezvous with the ore-ship.

The minutes ticked past. As he approached the *Goddard*'s airlock, he could see the ungainly configuration of the ore-ship closing in on their position. Dwarfed by the size of the *Dragonstar*, the approaching vessel looked like a flying insect, hovering with wings blurred into invisibility. It had already pulled alongside the *Goddard-Heinlein*, but Canter could see no external activity as of yet.

He switched frequencies, tuning in on the base camp intercom. Someone was talking, and Canter eavesdropped.

". . . like they're close-approaching for docking," said Bracken. "I've tried reaching them on the intercom but I'm getting no response. . . ."

"They must know we're having a communications problem," said Marshall. "Probably don't have their own equipment tuned to our specific frequency. Proceed with docking, Commander. . . ."

Canter slowed his scooter as he approached the ships. The ore-ship was nestling in beside the *Goddard*, lining up its docking collar with the deep space cruiser. He watched as the two ships became joined, siamese-twin fashion at the waists, and listened on the intercom.

"Ore-ship docking completed," said Bracken. "Their airlock is recycling. We should know what's going on in a minute . . . stand by, Captain."

After securing the scooter to the hull, Canter drifted across to the open-lock of the *Goddard*, on the opposite side of the fuselage from the docking collar. He cycled the lock, stepped inside, and pulled off his EVA helmet, hoping that someone on the boarding crew would recognize him. This was no time to get himself shot.

The main corridor was silent as he entered. He thought to check on the two engineers in the service module, when he heard footsteps to his left. Looking up, he saw a crowd of men wearing olive-green jumpsuits, LS-helmets and visors, and carrying weapons. The man in the lead turned and raised his rifle to his waist, aiming it. Canter threw himself against the wall, raised his arms in the bulky EVA suit, and started screaming to identify himself.

The lead man hesitated for a moment, and two others joined him, walking slowly up the corridor, their guns trained on him.

"It's Canter! . . . Rassim! I'm *Rassim!*" He felt a knot growing in his throat, and he feared that soon no words would come. They were going to shoot him, he was certain.

The lead man stopped, gestured him to move into the center of the corridor with the barrel of his weapon. "Rassim *who?*" he said softly.

"Pierre . . . Pierre Rassim! I'm with the *Jiha!*"

The leader lifted his visor. He was olive-skinned and wore a neatly trimmed, full-face beard. He smiled ironically. "Why are you here, Rassim?"

At first, Canter did not understand the

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question, but suddenly, the correct answer came to him: "I'm here for Ahmad Nesrudah . . ."

The leader's shoulders dropped perceptibly as he relaxed his grip on his rifle. "All right," he said to the other men. "It's all right." Then turning back to Canter, he said: "What's the situation here?"

"One man on the bridge. Two back this way in the service module. They won't be any problem. Nobody on board the smaller ship, and one man inside the entry hatch on a security post. There's only four men at the base camp. Everyone else, including Kemp, is at the other end of the alien ship." Briefly Canter explained the situation, and told the commando leader about the beacon at the aft-end, which marked the entry hatch.

"You suggest that we take the men in through there?"

"That's where they can control this ship, don't you see that?"

"What about these . . . lizard-men? Will they be a problem?"

Canter shook his head. "I don't think so . . . from what I understand, they have no technology to speak of. Listen, you'll only need a handful of men to secure the base camp; I can contact their headquarters and tell them that IASA people are coming aboard, and they won't suspect a thing. You take the rest of your men down to the other end of the *Dragonstar*, follow the signal from the beacon, and enter the same way as you were briefed on this entry. You should come up inside the saurian civilization. I'm sure you can take it from there."

The leader grabbed Canter by the front of his EVA suit, pushed him against the wall. "This was not in the briefing . . . it sounds crazy to me!"

"No! Listen . . . no one expected them to move the base camp! We had no idea that they would have access to the control section of the ship! We've *got* to change our plans, or this whole thing is a waste of time. Now, you've *got* to take out the man on the bridge so that I can use the intercom!"

The commando leader was going to speak again, but changed his mind. He released Canter and returned to his lieutenants, whom he briefed quickly. Twelve men remained on board the *Goddard* while the others were ushered back into the ore-ship by their bearded leader.

"This way," said Canter, leading a lieutenant and six men towards the bridge. The other six went back toward the service module.

Bracken did not even have a chance to turn around before he caught two bursts of fire. He fell from the chair in a heap, and Canter took his place, flipping on the intercom. "Captain Marshall, this is Doctor Canter . . ."

"What is it, Doctor? Where's Bracken?"

"We've got Doctor Kolenkhov and some of the Copernicus staff on board, Captain. They hitched a ride on the ore-ship to investigate our radio silence. They request permission to enter the *Dragonstar*. . . ."

"Doctor Kolenkhov!? You're kidding. Where's Bracken?"

"He's down at the airlock preparing to escort them through the entry hatch."

There was a pause before Marshall

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replied. "Why didn't Bracken notify me of all this?"

"He was kind of taken by surprise, Captain. I can't really blame him." Canter paused, forced a chuckle from his dry throat. "I mean, if you've ever met Doctor Kolenkhov, I think you'd understand. . . ."

Marshall paused, then replied. "Hmm, yes, I've heard stories about him . . . supposed to be quite a character. All right, Doctor, tell Bracken I'll be expecting him. Marshall out."

Canter turned and nodded to the commando lieutenant, who turned and led his men from the bridge to the airlock, where Canter passed out EVA gear to the half dozen men. As they suited up, the other six commandos arrived and began pulling on their own suits.

Once outside the *Goddard*, Canter led them through the outer chamber of the lock, took them through, and had them discard the EVA gear, and start up the ladder.

When they reached the platform below the hatch, Canter climbed up, opened it slowly, and saw Captain Marshall and another man waiting for him just down the knoll. He waved as he stepped out onto the spongy ground, and Marshall raised his hand to return the greeting. At that moment, three of the TWC commandos appeared and fired their automatic rifles. Marshall and his underling were cut down by the hail of slugs in an instant.

"Let's go!" cried Canter as he began running towards the headquarters dome.

Across the clearing, near the generating station for the force-field stood another man, ostensibly on guard duty. He was shocked into immobility by the sight of the two men being shot down before his eyes. He took cover behind a rack of equipment and started spraying the area with razer fire. Three commandos were lanced by the heat-beams and were cooked from the inside out, dead before they hit the ground. Everyone else dove for cover and pinned down the lone sentry with concentrated automatic weapons fire.

The only other man alive at base headquarters was Commander Douglas Fratz, who had been on break in the headquarters dome. He heard the gunfire, and ran to the window. He was shocked to see the olive-green troops scampering across the clearing, led by Doctor Canter. As he watched, he realized that it was only a matter of time before they countered the sentry's position, whoever they were. And Fratz knew what he must do.

"This is base camp, calling Colonel Kemp! Come in! This is Commander Fratz. . . ! Come in, please!" Fratz waited by the console, expecting the commandos to come bursting through the door any moment. *Come on, Colonel!*

"This is Colonel Kemp. What is it, Commander?"

Fratz summarized the events in a few quick sentences while the sounds of gunfire continued outside the dome.

"Jesus Christ!" said Kemp. "I'm about five klicks from landing the 'thopter there! Can you hang on?"

"Negative, Colonel! They've got ten, maybe twelve men out there. Heavily armed. Get out of here while you can! Get some help!"

"Try to hang on, Commander. We're heading back. Good luck, man. . . ."

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Fratz flipped off the radio, and noticed that the sound of gunfire outside had stopped. *I can't believe this is it,* he thought. *I can't believe I'm going to die like this. . . .*

As he turned to take cover behind the work-table, the door to the room flew open. There were three men wearing olive-green jumpsuits. Fratz didn't see their guns until the barrels flashed.

He never heard their report.

NINETEEN

Flying at the highest velocity that Zabriski would risk, the ornithopter struggled against the atmospheric caprices of *Artifact One*'s interior. Phineas Kemp's mind was experiencing a separate turbulence. What *else* could go wrong? He felt like some biblical character being tested by a malevolent and wrathful God. *How could the TWC have gotten control of one of our ore-ships?*

Hell. It didn't matter *now,* he told himself. What mattered was that they were inside the ship. The base camp had been wiped out. Kemp was certain that the commandos wouldn't stop there. If they knew where the majority of the crew was located, how would they get across the more than 150 klicks of hostile territory? How did they intend to take over *Artifact One?*

Change the course of the gigantic ship, most likely. Now that they had overrun the *Goddard,* the *Heinlein* and the base camp, they certainly controlled the new engines that they'd tacked on to guide *Artifact One* back into an accessible orbit around Earth. No doubt there waited more TWC ships in the area where they intended to redirect the alien ship. Once there, the game was entirely theirs. They could explore *Artifact One* at their leisure. Its secrets would be theirs to unlock.

However, Kemp and the IASA still had two wild cards to play, as desperate as their situation seemed.

First, they had the protection of the saurian wall, and hopefully the friendship and esteem of the saurian culture. In normal circumstances, that would not bother the TWC commandos. They could simply fight a war of attrition, with Kemp and his men the inevitable losers once the new destination was reached and the TWC could bring superior weaponry and numbers of troops into play.

But the wild cards could only be played together.

Essentially, for all practical purposes, Kemp's team still had control of the prized engines of *Artifact One.* Not only control, but *access.* It would take a while to get the mammoth ship to exactly where the TWC wanted it. Any time during that period, the IASA team could stumble not merely on the secrets of the *Dragonstar*—but the controls, the guidance system as well. If they *used* them—well, that would be an entirely different ballgame, with the TWC the inevitable losers.

There was no question that the TWC commandos would realize this.

No question that they would try to do something *about* it.

Kemp wondered what kind of weapons they had. How many men? All that made a great deal of difference.

He'd gone over the questions with Coopersmith when he'd contacted him

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by intercom, right after Fratz had warned him away from the base camp. It would be at least an hour before the 'thopter would reach the saurian Wall. A lot could happen by then.

The radio beeped. Kemp flicked on his helmet mike.

"Kemp."

"Coopersmith here, Colonel. Doctor Jakes and two of his men are with the Priests. They're taking them into the aft-end—"

"*Now?* Ian, for Christ's sake, we're under attack!"

"I know that, and *you* know that. I don't think the saurians really understand. We'd just finished convincing the Priests that they should show us the secret, sacred Pathway back inside the alien crew section when the shit hit the fan. I figured the best thing to do was to go on with it. Otherwise, I could have spent another two days explaining exactly what is going on with the TWC, and just *who* they are."

"Yes. That's probably for the best. They must know about everything, if Canter was their inside man, like Fratz said. They must realize that in order to have full control of the situation, they have to take over this section as well. So, we have to assume that they're coming, eventually. If they come across the interior, we've got plenty of time to prepare."

"But, Phineas, you know as well as I do that there are other access points from the *exterior*. Some quite close to the saurian civilization and the engines."

"Quite true. And they'll be in a hurry, won't they? You know, Coopersmith, I think we may well be in trouble. Set up some defensive emplacements immediately. Oh, and Coopersmith. In the saurian mythology, is there anything about a coming Armageddon?"

"I could ask, Phineas."

"Well, you tell them that it may well be here, *now*."

The entry shaft and hatch design were virtually identical to the one leading to the IASA base camp. Abu Jashad, the leader of the ninety-man commando squad, stood on the platform below the hatch, preparing to manually turn the gear-wheel which would free it. He signaled to his men below, then opened the large, rectangular panel.

Bright light spilled down.

He climbed up and onto the vine-covered ground, into the strange and rich smells of the interior.

Something was wrong.

Jashad could see no sign of any saurian cities. No saurian wall. Nothing at all that Canter had told him about.

Surrounding the clearing near the hatch were thick stands of primitive forest. Even though Jashad did not know the difference between a cycad and a ginkgo, he was aware of the strategic obstacle which enclosed his men.

Where *were* they?

He glanced up towards the center of the cylinder, checking the direction of the illuminating rod in an attempt to get his bearings. Behind him, the remainder of the assault team poured out of the entry hatch, each man momentarily stunned into immobility as he paused to stare at the hostile surroundings.

As his lieutenants gathered about him, the leader turned to one of them.

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"Get Canter on the radio. IASA frequency at the base camp."

"Fatah, here . . ."

"Get me Canter," said the leader. "The so-called 'Rassim'."

There was a pause while the leader waited. The forest around him and his men was alive with sounds. Scurryings in the ground cover, insect-buzzings, an occasional cry of hunger or agony.

"Rassim, here . . ."

"This is Jashad," said the leader. "What have you done to us!?"

"What's the matter? What're you talking about? Where are you?"

Jashad explained their predicament angrily.

"All right," said Rassim/Canter, explaining that he did not have time to properly locate an entrance within the saurian barrier. "Continue to broadcast a distress-call with your radio, and I'll use our scanning equipment to get a fix on your position. Stand by . . ."

Jashad held the radio by his side, trying to hide the frustration and the fear which he felt. Some of his men were anxiously guarding the perimeter of the small clearing, while others were pointing skyward where a group of pterosaurs glided by like large, burnt-orange kites.

The radio crackled and Rassim/Canter's voice was heard once again. "Rassim here . . . sorry for the delay. The instruments placed you along the same longitudinal axis as the base camp, and you are within five kilometers of the barrier. Can you see the flat end of the cylinder from your position?"

"Yes," said Jashad. "It is partially obscured by clouds and haze, but it is visible."

"Proceed towards the flat end. You should be able to see the barrier within five klicks, and be careful . . . there's supposed to be some rough characters out there."

"You sound like such an American, Rassim," said the leader facetiously. "It is *we* who are the 'rough characters'!"

"Whatever you say, Jashad. A thousand pardons. Good luck . . . Rassim out."

Jashad assembled the men, briefed them quickly, and struck out into the forest. They employed a point man, followed by a two-man file which snaked through the maze of trees cautiously. Before they had covered the first kilometer, the men were feeling the effects of the muggy, warm temperatures, and perspiration soaked their fatigues a deep, dark green. It was at that point that Jashad noticed something *different* about the surrounding forest. . . .

It was silent.

Abruptly, the insect-sounds had disappeared. There were no small things rustling in the undergrowth. Jashad signaled for the column to halt. "Listen," he said to one of his men standing nearby. "Something's coming."

The silence was replaced by the distant thrash of branches and the barely audible *whomp* of heavy footfalls. Something was closing in on their position, and it moved boldly without fear of detection.

"Keep it moving!" cried Jashad, as he paused, trying to locate the source of the intruding sounds. It seemed to be approaching the rear flank of the column, but he could not see very far within the lush green weave of the forest. "Double time!"

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The commandos slipped into a half-jog, bobbing and weaving, through a make-shift path. Suddenly a ravenous scream cut through the humid air like a blade. Turning, Jashad and his men were horrified to see a beast emerge from the tapestry of fronds and broad-leaves not ten meters from the men at the rear of the column. It was at least six meters tall, its tan and yellow hide in bold contrast to the forest. Thick hind legs moved like giant pistons as it surged forward, its huge head dropped low, great green eyes and grinning jaw riveted upon the commandos at the end of the column. Jashad did not recognize the gorgosaurus for what it was, nor did he care. Before he could shout any commands, the column had broken ranks and scattered into the forest.

Automatic weapons fire filled the heavy air with a steady ratcheting clatter as the gorgosaur charged, catching one of the men in its jaws like a power-shovel scooping up a chunk of earth. Raising its head, the beast tossed the man slightly and closed its jaws upon him. Two quick snaps, and the man disappeared as the beast paused upright to work a distended bulge down its gullet. Its belly and flanks were peppered with scarlet wounds as the commandos' slugs ripped into its hide but still it lowered its head and resumed its attack. Apparently driven to a feeding frenzy by the first taste of fresh blood, the gorgosaur had no care for safety. Another man stumbled as he ran from the beast, and was crushed beneath its splayed hind claws. The gorgosaur paused to pick the corpse from its foot, worrying the body with its forelimbs and eagerly snapping it up with its jaws.

Jashad signaled for the bulk of the column to move forward, spreading out among the trees, while the men closest to the carnivore continued to fire .40 caliber slugs into its thick body. Although showing no signs of injury, the gorgosaur raised its head and attempted to move forward again, stumbling and falling forward. It gave out a bellowing cry as it thundered to the ground, its heavy hind-legs twitching violently, its tail thumping the earth in a series of shaking death throes.

Finally the beast was still. As the commandos slowly crawled from their hiding places, grouping about the huge body, the scavengers of the Jurassic world began to appear. Little four-legged lizards scuttled out of the undergrowth to swarm about the gorgosaur's carcass. Clouds of insects materialized, descending on the still warm flesh to feed and lay eggs. Eat and eventually be eaten. That was the law of this world, and the commandos stood watching the display in a state of profound shock.

In the distance, there was the renewed sound of more bellowing and thrashing. The smell of blood and fresh meat was in the air and the scent was attracting other carnivores. Jashad marshalled his forces and cleared out of the area at double-time. *Damnable Rassim,* he thought as he ran for his life. *He was responsible for this travesty.* The *Jiha's* finest men being eaten like dogfood! Someone would pay for this, thought Jashad.

The forest blurred past them as they ran, spurred on by the unknown terrors behind them, and the growing fury of revenge that was welling up in them. Jashad triple-timed to the point of the

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column, exhorting his men with slogans and quasi-religious exhortations. The men screamed their responses as they ran, getting psyched-up, forgetting the horror which had almost destroyed them.

The trees began to thin somewhat as they moved closer to the barrier, and Jashad lost all sense of time as well as distance as they rushed toward their objective. Behind them, the forest was alive with the sounds of the beasts. Suddenly, beyond the stand of redwoods and conifers, the leader saw the high, featureless expanse of the wall. Even from a distance it looked formidable, and immediately, he was considering the best way to get over or through it.

"Spread them out!" he called to his squad leaders. "Take cover near the edge of the trees."

They moved forward, fanning out to face the wall and a short clearing which had been worn smooth by what appeared to be a fairly heavy concentration of dinosaur activity. As Jashad reached the cover of a large-boled tree, he studied the wall's composition—an ingenious combination of wood and stone and earth. There were buttresses at certain points along its length and at larger, evenly spaced distances, crudely built guard towers rose up even higher than the wall itself. Within the tower closest to their position, Jashad could see two lizard-like creatures, holding what might be cross-bows, staring out at the forest. They did not appear to have detected the commandos.

Jashad took a deep breath of the humid air, then signaled his explosives men. They scrambled through the undergrowth to his side: five of the best in the business, backpacks jiggling softly. Jashad wiped a frond out of the way and addressed the men. "Think you can put a hole in that wall?"

The leader grinned, his white teeth contrasting with his sweaty, dark skin. "No problem." He nodded over to the guards. "If you take care of those two creatures, we'll blow half the wall down."

Jashad glanced over at the saurians again, rubbing his beard, which irritated him in this environment. "I truly regret that we have to operate in this fashion. Would that we were the first to contact this extraordinary race! But amends can be made later. We have no time to waste, we must move forward immediately, and anything—human or alien—that stands in our way must be removed. I've never seen conditions in which the ends have more justified the means."

The explosives team poised at the dense edge of the clearing, waiting for the signal to run.

Jashad gave the signal for his sharpshooters to take their places, indicating what their targets would be. He watched them with pride as they inched forward, then aimed.

Such a shame indeed, thought Jashad as he put his binoculars over his eyes and focused them on one of the guards. Such an interesting looking creature, slightly taller than the average human, with large, bright eyes. Three fingers across from the opposable thumb. How fascinating! He hoped that after this battle, when the TWC was in control, when they had crushed or captured Colonel Kemp and his men, and penetrated the engine section of this mammoth starship, they could come to terms with

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these lizard-men. With a well-trained will, Jashad pushed any regret or guilt from his mind. Then he signaled the snipers.

Bullets were fired.

Jashad watched as they slapped into one of the guards. The blood which splattered was certainly red enough. The saurian jerked back, took another round in the face, then toppled over the side and thudded to the ground. With a downward gesture, Jashad signaled for the explosives men to advance. Then he called out for the sharpshooters to cover them.

The explosives men jogged forward almost as one. Within seconds, they had split up and taken their places at five-meter intervals along the wall. Quickly, bars of C-7 plastic explosives were slapped against the rock, cement, and wood. An explosive cap was immediately embedded in each one. These would be triggered by radio, once the commandoes were away and out of danger.

All was going well, until another of the saurians appeared at the left tower. This one had a different kind of crossbow, Jashad noted with surprise. On this one—slightly bigger—the quarrel seemed to be . . . *moving*.

The explosives team was already on the way back.

Jashad called out to the sharpshooters.

High-powered rifles cracked, bringing down the saurian guard.

But the quarrel had already been unleashed. It slashed down toward one of the men.

"Watch out!" Jashad screamed, quite unprofessionally.

The men quickly did zig-zags. The quarrel swooshed past the man on the left end, just missing him.

Almost immediately, it sprouted wings, swerved around in a tight arc, and buried itself in the man's soft underbelly. The commando gave an agonized scream. The quarrel's tail seemed to lash about like the tail of a snake. Blood flowed onto green khakis.

By the time that the realization that the arrow was a living thing dawned upon Jashad, the thing had already chewed halfway though his soldier.

Jashad cursed, then bawled for the others to hurry back.

The stricken commando writhed on the ground for a few seconds, and then was still. Sounds of tiny teeth snapping carried on the slight breeze.

Stunned expressions on their faces, the others returned to cover.

"Well, don't just stand there," Jashad cried. "I want that wall down!"

Immediately, the explosives team leader took off his backpack and picked out his radio control box. He selected the proper frequency, then pushed the button.

With the sound of rolling thunder, huge holes were torn out of the thick wall. Dust and rock spumed. Smoke and fire licked up. The top of the wall caved in. When the debris finally settled, there was a quite adequate opening in the saurian wall.

"Advance!" Jashad cried, gripping his own weapon with renewed intensity. Quickly, the guerilla force scrambled through the clearing to the edge of the rubble. Jashad peered over the fallen masonry and shattered wood beams. Two hundred meters away was the city

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that Canter had spoken of. But there were also quite a number of frenzied saurians advancing toward the TWC commando force. Some were riding their dimmer and bigger cousins.

"I know it's hot," Jashad called. "But we'd better erect our fighting suits." Quickly, he pulled his own from his backpack, wishing that all his men had the more sophisticated fighting suits employed in honest-to-goodness wars. But since with a terrorist/guerilla team mobility was the deciding factor, each man carried only standard defense: an oversuit, strategically reinforced with bullet-proof plastics in vital places. Jashad slipped this on quickly, then pulled his LS helmet down, adjusting the gas mixture to medium level performance. In normal actions, *swift* actions, the setting was PEAK. But who knew how long this business would last?

Without having to be told, the men carrying rocket launchers loaded their first rounds. Rifles were raised.

Jashad, feeling heady with the rich oxygen mixture flowing into the LS helmet, chinned his communication unit and was about to call for advance, when an alarmed voice blared into his earphone. "Commander! Behind! Look behind us!"

Jashad spun around. Emerging from the forest swarmed a group of about twenty unclothed saurians, armed only with clubs.

With frenzied screams, they raced toward the destroyers of the wall.

"Unit B!" Jashad cried. "Turn and open fire!"

Twenty men swivelled, aimed, and sent a volley of rifle fire into the ranks of the saurian attackers. Most of the lizard-men were cut down mercilessly, but two managed to avoid the bullet spray. They leapt upon two commandos. One was quickly dispatched by speedy knife work. Before the other could be killed, however, its club had smashed a commando's helmet and sharp claws had torn out the man's throat.

"Unit B, cover our rear," Jashad said. "The rest, advance. Get those rockets going at biggest defenders!"

This was *not* going to be so easy, after all.

They charged forward. At a range of fifty yards away from the saurian defense force—an impromptu one at best, Jashad noticed—the launcher men kneeled and aimed their rocket tubes. Smoke flashed. With a boom and a thud, the first rocket penetrated the chest of an iguanodon, literally blowing it apart. Methodically, each of the burden beasts were so disposed of.

At the range of twenty yards, the other commandos flopped to the ground on the order of Jashad. Rifle cracks ripped the air. Within minutes, perhaps a hundred saurians lay writhing or dead on the plain.

More, however, swarmed from the city, carrying wooden swords and crossbows fitted with their living bolts. Soon Jashad was swatting away the persistent creatures trying to bore their way through his suit. Several of his men were killed in this fashion, when their suits were penetrated. It was a slow and agonizing death. The things more than unnerved Jashad, but his years of training put him into kind of an automatic control of the situation.

Suddenly, he heard fierce roaring from behind him, loud to him despite

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the helmet. "Jashad," the voice of Unit B's leader cried over Jashad's earphones. "Rocket launchers!"

Jashad turned.

Emerging from the forest were the most fearsome beasts he'd ever seen. An allosaurus was slinking forward, mouth open wide anticipating a feast. Following it closely was a tyrannosaurus. Both had no doubt been attracted by the scent of blood. Growls of other creatures echoed their bellows in the distance.

The party had been announced, the feast proclaimed.

Jashad swore violently as he crouched and chinned the comm control. "Unit C. Lower numbers, up to Five. Detach from ranks and cover rear."

With practiced speed, the specifically numbered men with rocket launchers broke ranks and ran back to join Unit B. Even as they did so, Jashad saw with dismay that other unclothed saurians were slipping around the sides of the broken wall, dodging the roaring carnivores.

A rocket fired. A chunk of tyrannosaurus blew away with a blast of smoke and blood. The monster paused only a moment, then forged away. Another rocket, fired recklessly, missed entirely.

With a prodigious leap, the tyrannosaurus attacked the closest of the riflemen, snapping him off at the thighs. The disconnected legs wobbled a moment, then teetered over. The tyrannosaurus chomped quickly, mechanically, ignoring its wounds. Bullets splattered its chest to no apparent affect.

Jashad cried, "Advance through the town!" The defenders had been thinned out, and if they could break through, they would have the shelter of the city to assist their efforts to stay alive. He could see that the rear defense would soon become a bloody carnage. He hadn't counted on this place's fauna to come to the aid of its beleaguered intelligent cousins. But then, to a hungry dinosaur, it didn't make any difference if he were eating a human or a saurian. If the commandos were to break through the saurian army, or whatever had met them, then the saurians would be left to deal with the invading monsters.

Losing about ten men in the process, the commandos managed to do just that. Sweating profusely, Jashad stopped to catch his breath. His bayonet dripped with saurian blood.

The sound of engines came to his ears. The sounds of whirring propellers . . . Jashad looked up. An ornithopter flew over his head, maybe a hundred meters high. His first inclination was to order it shot down. But when he realized that the flying machine was passing without attempting to attack the commandos, he decided to let it pass.

Already a possible alternative plan was in his head.

There *had* to be an alternative plan because this plan was not working well at all.

Colonel Phineas Kemp peered through the bubble of the ornithopter.

"Stay at this altitude, Zabriski!" he said. "They might try a few pot shots at us, though I must admit, they *do* look rather busy down there."

"What's going on, Colonel?" Zabriski wanted to know.

"All hell's breaking loose. No time to watch, though. Get down to that tem-

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pic over there! Becky and Ian are in there, and I don't want the commandos to get hold of them." As he lifted his communication unit, he examined the panorama of destruction below. Those saurians with the clubs and no shirts; they must be the warrior class that Coopersmith mentioned. How had they been notified that danger threatened? Well, the answer could wait until later, Kemp thought as he punched the button on his comm unit.

"Coopersmith, we're coming in! Be landing in a moment. Where are those emplacements I ordered? Our friends the saurians could use a little help."

"Shit, Colonel, I know," Coopersmith's voice responded. "But they didn't take the logical entrance. We figured they'd be hitting the wall about five klicks away. I don't know if it was a surprise tactic or an accident, but they must have had to walk through a lot of jungle to get here."

"Well, get them back here, quick!"

"Already done."

"And get ready to go. Tell Becky we're taking you out of here!"

"No objection, Phineas. The fighting sounds pretty heavy out there."

"It is. Coopersmith. Over."

Phineas Kemp took one last look behind as the battlefield was lost to sight. His last image was that of an allosaurus tromping through a group of TWC commandos, while holding one in his jaws like a limp cigar. The tyrannosaurus had finally been felled.

"My God," Kemp said, shaking his head. The ornithopter began to lower, coming to a final rest by the temple of the philosopher-kings. "I wonder if the TWC would have come if they knew what was waiting for them."

"I wonder if *we* would have, sir," Zabriski said. "From that Snipe onward, things haven't exactly been rosy with *Artifact One*."

"It will all work out, Zabriski. It will be worth it all."

"Right now, I just want to get out of here alive."

The ornithopter rocked to a halt. Kemp slid the door back, hurtled out, and raced for the temple steps, which he took two at a time.

Coopersmith was in the hallway.

"Where's Becky?" Kemp demanded.

"She's collecting some of the saurian manuscripts. She doesn't want them destroyed by the TWC."

"Damn the manuscripts! Get her, *now!* I'm going to raise the troops on the way here. Then we're going to get the hell *out!*"

The clattering and booming sounds of the conflict were rapidly drawing near. Kemp drew his pistol, then began to pace nervously. To have come so *far*, despite all the obstacles—and then to lose it! The thought was almost too much to take. He was almost ready to abandon them. They'd made it in the wilderness, hadn't they? This business was more important than a couple of lovebirds. . . .

He shoved the thought from his mind, realizing that it was born as much of jealousy as impatience.

A minute later, Becky came bouncing out, scrolls under her arm. Kemp glared at her angrily, and was about to yell at her when Coopersmith, his own pistol drawn, bounded out athletically. "Okay!

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Let's go! I saw a detachment moving down the street from a window. No time to waste!"

They ran out to the waiting ornithopter.

Funny, thought Kemp. Why had Zabriski opaqued the polarized glass?

Unless . . .

"Coopersmith, no!" But Ian Coopersmith was already hauling at the sliding door.

Three handguns bristled from the cabin, held by men in battle suits. "Ah, Colonel Phineas Kemp," a man with a beard said. "I suggest that you put your weapons down. We have much to talk about."

Zabriski called, "I'm sorry, Colonel. They just stormed in before I knew what was happening."

Frustration clenching his gut, Phineas Kemp sighed and threw his pistol in the dirt.

TWENTY

"So, Jashad," Kemp said sourly, "you're just leaving your men to be scarfed up by dinosaurs." He gazed out the bubbled glass down at the land streaking past below, watching the shadow of the ornithopter flow unsteadily over forest and saurian grain fields and saurian buildings. He'd never felt so low, so *beaten* in his life.

"The fighting men of the TWC were aware of the danger," the dark, bearded man said. "They have always been willing to give their lives for our cause."

"Bloody well drilled *into* them, I don't doubt!" Coopersmith spat sarcastically. "Is that all you people know? Violence?"

"We were well taught by your peoples of the West, my friend. After so many years of oppression, we learned the ways of survival."

"Political tommyrot!" Ian Coopersmith said. "Propaganda! I'm part West Indian. My ancestors knew *real* oppression, and I know the difference between efforts to survive, to maintain dignity, and a full-scale power play by a world cartel. You're just a puppet, Jashad. A puppet."

"I can see the strings moving your mouth, Ian Coopersmith," Jashad said, nonplussed. "Perhaps we are all pawns. But the game is interesting and worthwhile, is it not? The keys to the universe? I would wish that *this* pawn's masters had those, and not your side. That is an honest emotion, I assure all of you."

The TWC commandos had tied them all up, except for Zabriski, who was flying the ornithopter. They did not want to fire a gun in the cabin. Therefore, one of the commandos, to emphasize their determination, now merely held a knife to Rebecca Thalberg's throat.

Jashad knew about the temple with the portal into the aft end of the ship. Jashad had demanded to be taken there, immediately, and he was, of course, getting his way.

"My men can take care of themselves," Jashad continued. "There will be many casualties, true. But once they take up a fortress position in the city, they will be able to endure long enough to be eventually aided."

"You *hope*," Becky said defiantly.

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"Yes. I do hope," Jashad said. "I also hope to be at this temple soon. How long, pilot?"

"Just a minute more," Zabriski. "The barrier's coming up."

Already shreds of mist had begun to envelope them. This part of the cylinder was shrouded in a permanant light fog, due to the air currents and collected water vapor. Zabriski leaned forward, and pointed. "That's it, right over there." So saying, he tilted the ornithopter toward the structure.

The temple stood in bright contrast to the dull grey alloy behind it. White pillars rearing over a long series of steps were the only resemblance to Earthly temples. Otherwise, the architecture, like that of the other saurian buildings, seemed based more on organic principles rather than geometric, as though to celebrate the aesthetics of biology. Thus, the temple had all kinds of cupolas, towers, mounds, and protrusions, linked by vein-like passageways.

"Set us down right by the steps," Jashad said. Then a thought seemed to occur to him. He swivelled to Kemp. "Are there guards?"

Coopersmith answered for him. "Only at the actual portal inside the temple."

"How many?"

"Four."

"Will it be necessary to kill them? Or would you people be so kind as to extend your carte blanche to your esteemed captors?"

"I don't want to see any more people killed, human *or* saurian," Kemp responded immediately. "We'll see that you get through."

"Excellent! I must admit that when possible, I abhor violence."

The ornithopter dropped down. The prisoners were untied. Prodded by pistol butts, they led the way through the entrance of the saurian temple. Torches flickered in the dim recesses of winding passageways. The place smelled of musk and mystery. Coopersmith led them down a series of tunnels, padding footsteps echoing eerily.

The corridor ballooned into a large chamber, filled with light and the smell of burning oil. At the other end, Dr. Robert Jakes was trying to communicate to the guards, waving his hands with frustration.

Upon seeing the new arrivals, Jakes hailed them and proceeded to run toward them excitedly. "Colonel! The door at the end opened for us. You should *see* what's inside—" Halfway there, he noticed that Colonel Kemp had company. He was about to turn and race back, when Jashad brandished his gun.

"Please. I wouldn't run away," Jashad said. "You must show us what you have found. I am very excited. Very excited indeed."

"Colonel Kemp?" Jakes turned to his commander.

"May I introduce Mr. Jashad of the TWC, Doctor Jakes. He and his hoodlums are in charge now."

A strange smile crept over Jakes's expression. "Ah. I see. They've come for the stardrive."

"You are a very intelligent man, Doctor," Jashad said. "We have come for all the secrets, all the *power* that this vessel holds. It is rightfully ours."

Jakes nodded, his expression growing stranger. "Oh, I'm sure you'll get a big kick out of what's waiting for you back there, all right."

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Coopersmith said, "What do you mean by that, Doctor?"

"Come with me. All of you. And you'll see."

It took only a few minutes to convince the guards not to give the TWC commandos any trouble. The saurians seemed quite as excited as Dr. Jakes. Something *had* happened, Kemp thought. Something big.

The doors were opened for them. Immediately, it became apparent that the new corridor was not constructed by the saurians. The walls were of the same metals as the cylinder end. Electric lights shone from their placements in the walls. The corridor stretched straight ahead.

"I am curious," Jashad said, his features losing some of their tension lines as they were melted with awe. "If the saurian culture has had access to this section of *Artifact One*, as you call it, all this time, why are they not more advanced in technology?"

Dr. Jakes explained, uneasily, after getting a nod of permission from Kemp. "Apparently, all this time they've only had access to this particular passageway. When they first showed it to us, we were astounded, and you'll see why when we turn around this corner up here."

They executed the turn, the commandos still keeping their handguns trained on the captives. When he saw what awaited, Jashad obviously had a hard time keeping his attention on his proper TWC duties.

He muttered an exclamation of astonishment in his native language.

Kemp, who had not seen this section of the corridor, was equally impressed. "I can see now why this is a holy place. No wonder these creatures have such a rich mythology."

Stretching along one wall for a length of fifty meters was a panorama in three dimensions, that in pictures and sounds and smells described the life and death of the universe in symbolic terms.

Dr. Jakes tapped the glass cover of it. "Unbreakable. They couldn't get inside to see how it works if they *wanted* to. Now. If you'll notice, the middle section here is a complex symbology —almost a mandala—of biological cycles. As far as I can tell, these permutations that the streaming pictures go through are *teaching* methods to explain a non-technological method of genetic control. Hence, the saurians' mastery of bio-systems—to a certain extent, at any rate. I suspect that there's more represented here than they can yet understand." Dr. Jakes walked along toward the end of the moving mural.

Kemp, despite his sense of defeat and his anxiety, was dazzled. Colors flowed in intricate patterns. Representations of life forms, chemicals, genes and molecules moved in a majestic dance that was beyond his comprehension. Strange music filtered through the air. The principal motif of the symbology were pictorial variations of the saurians themselves.

"This was *placed* here! On *purpose!*" he said. "To teach . . . to teach the reptiles that found it."

"Not only that," Dr. Jakes said, voice brimming with excitement. "Come have a look at *this*."

At the far end of the mural was a holographic miniature of the Sol system. Included in the holograph was a

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representation of the very starship they were on now. The final depiction in the array was that of a creature metamorphosing from one variation to another.

"My God," Becky said. "It looks kind of like a man, now. Could it be, do you think, the creatures that created this ship?"

"No," Jakes said. "No, what you're seeing is a mathematical projection of all the possible ways that evolution might have produced intelligent life on the planet Earth." He breathed a sigh and shook his head with something like incredulity. "I know that because of what I've seen beyond the final portal. Believe me, this is just the beginning."

It took a good deal of willpower to pry themselves from the dazzling wonders displayed on the wall mural, but eventually Dr. Jakes persuaded them to continue.

The corridor stopped dead in front of them.

"This is the end of the road for saurians," Jakes said. "At least for a while."

"What do you mean?" Kemp asked. "Why isn't it the end of the road for human beings?"

"There's no way to analyze the reasons now, but I suspect they are complicated. And yet— Watch." He stepped up to the wall. "Now. Where is that panel? Ah. Here." He placed both hands up. The whole side of the wall began to glow white.

With a click, a door opened.

Subtle shadings of bright colors streamed through into the comparative dimness.

"Your eyes will accustom themselves, soon," Jakes said. "But come. My assistants are on the other side, taking readings."

Wordlessly, the party shuffled through the opening into wonder. The handguns of the commandos were nearly forgotten by both captors and captives.

The theory had been that this section of the ship would not only hold the stardrives that powered this mammoth vessel, but also the control section as well as the crew quarters. There had been excited conjecture that if the alien race that had built this ship had enough technological sophistication to create a reconstruction of the Earth's Jurassic age within the main part of the cylinder, then they might have created a recreation of their home planet's environment in the aft end.

Nothing could be further from the truth.

Machines.

All the way around the circumference of this section stretched alien machinery. Large and small machines, oddly shaped machines, differently colored machines. No illuminator burned above, though—only a thick rod stretched the kilometer distance between the walls. A part of the generator, no doubt, Kemp supposed. Much of the machinery was no doubt for environmental maintenance, but still. . . .

"It was dark when we came in here, Colonel," Dr. Jakes said in a subdued tone. "But as soon as we walked just a few steps, these lights came on. All around the periphery. We immediately did just as you ordered, Colonel. We searched out the stardrive."

Suddenly, Jashad's eyes burned with intensity.

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"Yes, Dr. Jakes. By all means, tell us about the stardrive!"

Jakes broke out in light laughter.

Angrily, Jashad waved his gun. "I am not to be mocked, Dr. Jakes, nor is our holy purpose to be mocked!"

Jakes sobered a bit. "Well, it looks as though our whole concept of this ship has been mocked. As best *I* can tell, from an hour's examination, based on all I know of physics and engineering, there *is* no stardrive on *Artifact One*. The propulsion engines, in fact, are quite similar to the ones *we* use. Only bigger, of course." He sighed. "This, gentlemen, is most definitely *not* a starship."

Kemp had never been so stunned in his life.

He felt the stars dwindle away out of reach. His hopes crumbled, and his wonder funneled back into despair.

Jashad, however, was furious. "You're lying, you Western scum. You're *lying!*"

Jakes shrugged. "Take my word for it, I'm not. I assure you, however, that there's plenty of knowledge to be had within this section. Evidently there are more computer banks here than on the Eastern seaboard. From the feeling I get, though, there is nothing here that will give the TWC domination of the universe, Jashad." He could not suppress a wide grin. "Sorry."

"How do you know these things?" Jashad demanded. "How can you be sure?"

"I've just taken the aliens' word for it," responded Jakes.

"They're here?" Rebecca said. "There are extraterrestrial beings here, now, *alive?*"

"No. There aren't even any signs of our hypothesized crew quarters. In fact, as far as I can see, there is absolutely no evidence of exactly who or what the creatures that created *Artifact One* really were. We might run across a few tantalizing clues as we examine the evidence. Nothing more, however."

"Okay, Jakes. Come clean. How do you know so much after being in here only a few hours?" Kemp was irritated.

"Quite simple, Colonel." Jakes said. "You recall that holographic mural outside? Well, it's clearly intended to instruct the intelligent reptilian life that the—the ETIs, let's call them—that the ETIs foresaw or even *manipulated* into their eventual form millions of years ago. Influenced, no doubt, by specifically measured radiation emission from the illuminator. But the saurians not only had to find it first, they had to understand it. Apparently, folks, the ETIs left something similar for us human beings. For similar reasons." He coughed. "You see, this is not just the only entrance that the lizards could use. It's the only one that humans could use."

"Wait just one moment, Doctor!" Coopersmith said. "Are you implying that they knew we were coming? That doesn't correlate at *all* with the theories about this ship. I mean, no *stardrive?* What you're saying is that this ship was put here in orbit *on purpose!*"

"But why fill it with dinosaurs, for God's sake?" Kemp demanded. "It doesn't make any sense!"

"It does if you start thinking about *Artifact One* in a different sense. A different system of thought, gentlemen. A different approach. Now with the givens

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I have presented, what conclusions would you come to?"

"A gigantic ship filled with dinosaurs in their natural environment," Becky began, running down the facts. "*No* stardrive. A saurian culture purposefully nurtured and educated by the mechanisms of this vessel, but unable to pierce this far into the ship's control section. A door that opens automatically upon the presence of human beings—creatures *anticipated* by that mural outside, in some form. . . ."

"One last thing of importance," Dr. Jakes said. "Come here." He led them past a smooth, large mound of metal. On the other side stretched a mural of similar scope to the one in the corridor, yet obviously much more complicated. Instead of explicit symbols, computations and equations seemed to flow in a never-ending cycle. Lights flashed in various configurations of form and color. "As near as I can guess, it's not only a teaching tool, but a kind of catalog of the systems and computers and other machines in *Artifact One*."

"I don't understand," Kemp said. "I don't understand at all. You mean to tell me that whoever created this ship *knew* we would find it?"

"Not only that," Becky said in a somber whisper. "They also created us. Can't you see, Ian! The *Dragonstar* is some kind of gigantic test-tube! A discarded test tube!"

"If this is a test tube," Coopersmith said, "I sure would like to see the laboratory!"

"No," Jakes said, shaking his head emphatically. "I studied this—this primer, shall we call it. That is not the indication that *it* presents. The ETIs did *not* create life on Earth."

"Well, then, what did they *do?*" Jashad demanded. He seemed every bit as enrapt with the unfolding explanation as the others. Evidently the others did not understand English. However, they seemed hard-pressed to keep their attention on holding up their guns, so fascinated were they by the whorls and swirls of color upon the mural.

"From what I've gleaned from the information presented here—along with some intuitive leaps, I must admit, my conclusion is that they *shaped* life. They used this artificial environment to test life-forms out. Or perhaps what we have here is the *reason* that dinosaurs became extinct upon the Earth. The Shapers decided to opt for the evolutionary pathway that led to the development of mammalian intelligence rather than reptilian. Perhaps they were family folk, and favored the development of the limbic system. But this is merely conjecture."

"Wait a moment!" Becky said. "I thought that the creatures here were from the Jurassic age. Didn't the extinction come later?"

Kemp said, "Funny. Mikaela just mentioned to me a few days ago that *her* conclusion was that there were creatures from the Cretaceous period as well, which would jibe with Dr. Jakes's theory."

"You mean to tell me that the ETIs spent millions of years hovering about Earth, shaping?" Becky said. "That doesn't sound very likely to me."

"Who said that they had to hang around all that time?" Dr. Jakes said. "They could have set things in motion,

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then come back to check how things were going every two or three million years. In other words, this ship is a *lot* older than we thought. But let me start from the beginning.

"I suspect that the ETIs' mission, initially, was to scout out the proper beginnings of life. According to modern theory, this solar system is about five billion years old, with Earth essentially being 'born' about four point six billion years ago. Now, about three billion years ago, large amounts of oxygen began to be produced on Earth from the ultraviolet dissociation of water molecules and also perhaps from green-plant photosynthesis. Things we might call plants thus produced their own nourishment from sunlight. The seas became a veritable broth of just the right chemicals. With the addition of electrical storms applying catalytic heat, variations, *mutations*, if you will, produced the first proto-amino acids and other favorable conditions for the beginnings of animal life. Rather like the theory that if you stick a hundred monkeys in front of typewriters, they would eventually produce the works of Shakespeare, given enough time. There are just so many combinations before life was formed. The amino acids, of course, are the basis of protein and also the essential chemicals involved in the DNA code. One-celled animals came into being. Changes in the DNA occurred, and so the cells changed, and then they joined into colonies . . . and well, you know the rest. This took billions of years. We've some fossil relics that prove this. So essentially, the ETIs stumbled onto the Earth at about the end of the Permian age—and began their shaping. Inside of *Artifact One*, they developed a similar environment to the Earth's surface and began accelerated experiments to determine just what the ecology should be in order to eventually evolve life. Do you notice that there *aren't* any mammals here? You know, at one time, I suspect there probably were. Only they were all transferred to the Earth's surface. When the ETIs were eventually satisfied with the programs they had keyed into the evolutionary and ecological computers, they set *Artifact One* into elliptical orbit. They left behind their teaching device for the developing saurians. And they prepared the mural we see here for the express purpose of educating any creature intelligent enough to key the brain scanners. Evidently, we fit that description, as I suspect the ETIs thought we would, if we could *find* this ship, and get to it, and into it."

"But why was our first ship blasted? Why all the death and pain it took to get here?" Kemp demanded imperiously.

"I suspect that was our own fault. After all, it was because of our stupidity that that Snipe ran into trouble with what, after all, were merely devices to protect the hull from meteors and asteroids. And we were stupid enough to enter through the middle of the cylinder, rather than near one of the ends! I strongly suspect that we barely passed the brain scanner test!"

"Well, we *did* make it," Kemp muttered grumpily. "And what good is it going to do us? The TWC has got the secrets."

Jashad grinned.

Jakes sighed. "Oh, you militarists,

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you politicians, you stupid fuggheaded twits!''

Jashad frowned. Kemp frowned. Coopersmith couldn't help but chuckle. Becky rolled her eyes.

Jakes continued. ''Don't you understand what I've been telling you? The ETIs certainly weren't going to leave anything here that would tell us how to kill each other, or how to gain power, or whatever. The stuff here is for *all* mankind. What we have here is not so much the keys to the stars as the keys to our own planet, to unfolding the potentials of the human race in our own environment. Now, that very well may lead to ventures into the stars, but only after we get our heads straightened out. The fact that the ETIs exist tends to suggest that there are plenty of advanced civilizations in the Galaxy. You don't think that they're going to put up with an Earth civilization typified by fascist, arrogant anal-retentives like *you*, Phineas Kemp; or merciless barbarian terrorists like you, Jashad.''

Both Kemp and Jashad bristled, but said nothing.

''No. And as a matter of fact, my friends, I suggest that we start examining this storehouse of wisdom fast, so we can get our act together as soon as possible,'' Jakes said.

''Why do you say that, Doctor?'' Becky asked.

''One last thing of importance. When my men and I first entered the portal, not only did the lights go on all about, but an alarm rang for about thirty seconds. Not really an alarm . . . I really don't know how to explain it. At any rate, I have located the origin of that sound. If you walk about a hundred meters that way,'' he pointed, ''you'll find the remains of a one-shot tachyonic transmitter which has burned itself out. Evidently a signal was beamed to the Universe when we entered.

''Folks, the ETIs know we're here now. I suspect they'll be here sometime in the future to see how their little project has progressed. I wonder if they'll be pleased to see what we've done to the Earth and to ourselves.'' He turned to Jashad. ''If indeed you do claim this ship, you and your holy TWC, you will also be the ones who will have to answer to those that come, Jashad. Do you think that the TWC is ready for that responsibility?''

Jashad said, ''It is our holy responsibility! It has been prophesized that our races shall lead the peoples of the world, under the leadership of Allah!'' But the man seemed to invest no confidence in these words. Indeed, he seemed quite nervous, now, quite unsure.

''And you're calling *me* fascist, Dr. Jakes,'' Kemp said, trying not to sound arrogant. That little comment had hit home hard. ''So, Jashad. What are your plans now? Clearly, this is not what you're after. Or *me* for that matter.''

''I must confer with my fellows,'' Jashad said softly. ''Dr. Jakes, where are your men? We must search them out. I do not want them in control of this ship's power, stardrive or no!''

''No problem. Evidently there's no fuel anyway. But you can check that for yourself now, if you want.''

''No. I must confer!'' He waved his gun. ''Come!''

Prodded on by the weapons of the commandos, they turned their backs on the technological wonders and pro-

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ceeded back through the passageway to the muggy environment beyond the temple.

Jashad pounded on his comm-unit. He screamed into the transceiver again. Still no response.

He looked up from the device, unable to conceal his worry.

"Want to try mine?" Kemp offered sarcastically.

"Shut up," Jashad snarled. "I'm sure—"

"Colonel! Look over there. It's one of our omni-terrain vehicles, headed this way!" Coopersmith said.

"Back inside the temple!" Jashad barked. "Hurry!"

Even as they walked back up the steps of the saurian structure, Jashad's comm-unit began to squawk out a message in a language that Kemp did not understand. Jashad held up a hand for all to halt. They waited until the inter-communication was through.

"Do you understand what's going on?" Kemp asked Coopersmith.

"I got a few words. Apparently, Jashad's invasion force did not do as well as he'd hoped. In fact, except for a few lucky men, it's been entirely wiped out. Not only that, but apparently the TWC folks in charge of our base camp forgot to keep the force-sphere on. A lot got eaten by a rampaging crew similar to the welcome-wagon creatures that met our first party."

Jashad's eyes were wide. He seemed to forget about the arrival of IASA reinforcements.

Smiling grimly, he called out orders to the three TWC commandos. They holstered their guns immediately, looking quite relieved.

"I have reconsidered, Colonel," Jashad said, keeping his gun out. "I am much impressed by the message of peace and understanding presented to us all in the control section of the ship. I would like to be the first of my peoples to begin some true parlays. We *must* try to understand one another!" He smiled unctuously. "In return for your assurance that no retribution will be taken against me and my men for our—our little expedition—I will immediately surrender my control over you and your friends. You must also promise me asylum and protection from those of my government who will interpret my surrender as failure. In turn, I will assist in the holy process of peacemaking, trying to communicate to my peoples what I have witnessed this day, and explain what it means to them."

"Afraid they're going to string you up for botching the job, Jashad?" Kemp said tersely.

"I'm afraid that certain of my more radical masters are not so merciful, Colonel."

"Fine. Give us your weapons. I swear that you will be able to keep your lives, and help us later on in whatever efforts it takes to communicate all of this to the entire world."

"And I will have my freedom?" Jashad asked. "I will not be thrust into one of your corrupt courtrooms and there be unfairly tried?"

Kemp stepped forward. "No trials, no incarceration. You may live out your days in the service of the peace between nations that you now profess to desire. He stuck out his hand. "But first, give

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me that gun. And tell your men to disarm themselves, slowly."

Uneasily, Jashad glanced over to the nearing OTV. Weapons gleamed in the light of the illuminator. Jashad handed the revolver over, butt first, then rapidly ordered his men to unholster themselves and drop their belts onto the ground. They obeyed.

Kemp took the TWC leader's gun.

"Oh. There is one matter left between us that has to be take care of, Jashad."

Visibly relieved, Jashad said, "Oh? And what is that, Colonel Kemp?"

"This."

Phineas Kemp threw a haymaker into Jashad's jaw, knocking him down.

Jashad, bleeding from the mouth and nose, looked up from the ground, astonished, dazed.

"That's what I'll have to satisfy myself with, you murdering bastard."

The OTV pulled up beside them. Four IASA men, guns drawn, leaped from their seat and trained their weapons on the TWC commandos. The anger and hate on their faces showed that they would be more than glad to use those weapons

The commandos hoisted their hands above their heads in desperate surrender

Jashad cursed and bled into the alien soil.

TWENTY-ONE

Rebecca Thalberg handed Phineas Kemp his cup of coffee. "One sugar. Just a dash of cream. Lukewarm."

"I'm touched," Kemp said wearily. "You remembered."

She ignored his implicit sarcasm. "Are you sure you want this? Maybe you should just turn in. It's been a long day."

They were in the mess hall of the *Heinlein*.

"You know he's married, don't you, Becky?"

Kemp did not look at her.

"Men like Ian usually are."

"You love him?"

"Very much."

Kemp sipped at his coffee. Absolutely perfect. Better than he could have made it himself.

"What about *him?* Does he feel the same way?"

"Look, Phineas. We were two lost people. We needed each other." She shook her dark hair. "Oh. That's right. You don't know what it's like to *need* someone, do you, Phineas?" There was no rancor in her voice.

"So then." Kemp could not look at her. He held his emotions in rigid check. "Is he going back to his wife?"

"That part of our relationship is over, Phineas."

"Oh?" Kemp looked up, unable to keep the hope from his eyes.

"And I'm afraid that that part of *our* relationship is over as well, Phineas."

Kemp was stunned. "But, Becky—if it's that way with Coopersmith—why?"

"Because I know the sort of man I want now, Phineas. And I'm afraid that you just don't fit the bill. I'll always be fond of you. We can't help but be friends. That is, if your pride allows."

"God," Kemp said bitterly. "What a way to end the day."

"Things *have* been twisted around a bit, haven't they?" She went to him and

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gently put her arms around his neck. "Our whole concept of where we came from, where we're going—as a race, and as individuals. I've changed, Phineas. You have to understand that. I have to get my own life together before I can minister to someone else's."

"I never—"

"Shh. You're upset now. You're fatigued. We can talk about this later. We'll have plenty of time, Phineas. I have the feeling that the rest of our lives are going to be quite exciting. This is just the beginning."

"I think I've had enough excitement for a long time."

"You don't blame yourself, do you, Phineas?"

"Well, let's just say that ever since we first caught sight of this ship, my self-esteem has been knocked down a few pegs."

"You'll live." She patted him on the shoulder. "Ian estimates about another week and a half before we get to L-5 orbit."

"Yes. Thank God we can at least rely on our technology."

She leaned over and kissed him on the forehead.

"Good night, Phineas. I'll see you at breakfast."

"Good night, Becky."

She sauntered out, pausing for a moment at the exit, as though she had something else she had to say.

Mikaela Lindstrom, carrying a tray with a sandwich and a glass of milk atop it, brushed past her with a mild greeting.

Becky smiled to herself, then left.

"I should have asked you if you wanted something to eat," Mikaela said as she set down the tray. "Want half of a tuna fish on rye?"

Kemp shook his head. "Hungry work, realizing the truth about your universe, isn't it?"

Mikaela said, "It still hasn't sunk in yet." She took a swallow of her milk.

"I'll tell you the one thing about it all that bothers *me*," Kemp said. "*Why?*"

"Why what?" Mikaela asked.

"Why did the aliens do it? It just doesn't make any sense."

"Well, perhaps it is irrational. But you know, Phineas, there is more to existence than the strictly rational view." She was thoughtful for a moment. "Okay. Let's take an example. Human beings. When people get to be of a certain age, a certain *maturity*, when they see that they can't continue on indefinitely, isn't their natural inclination to begin a family, to have children who will carry on after them . . . and so on? How do we know that when a civilization reaches a certain maturity in the cosmos, its natural inclination isn't to spawn another, *different* civilization? That's what this one did, evidently, with the raw materials that were available to it. I mean, Phineas, doesn't it feel good to know that somewhere out there are our *parents?* And they may well be here anytime to say hello. It's staggering, that's what it is."

"I suppose I'm just a bit homocentric. I always dreamed of being part of the spearhead to the stars myself," Kemp said.

"This is paradise for me, Phineas. I *love* it here. All the things we're going to discover . . . have *already* discovered. It makes me grateful I'm alive."

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She munched her sandwich. "It certainly gives me an appetite. You're certainly cheerful, Phineas. Come on, brighten up! Everything has turned out at least reasonably well." She put down her sandwich, and looked at him. "Oh. I suspect that Becky's told you how things stand with you two."

"That's right."

"I pretty much saw it coming."

"Oh, did you?"

"You must admit, scaled against the rest of what's happened today, it's pretty unimportant."

"She's alive, and she's well, and she's doing what she wants to do. I guess that's what's important, isn't it?" Kemp said. "Well, at any rate, Mikaela, I just can't help feeling that my relationship with Becky is just one more thing I've screwed up in my life."

"You feel cast adrift, I bet. Unable to relate to what's happened, or to who you used to be. You've changed, Phineas. It happens to us all. You'll grow because of it, I assure you."

"You've been through things like this before?"

"Oh, all the time. I've had a few fairly traumatic things happen to me in my life that seemed to leave me out in the cold. I've survived, though."

"I didn't realize. You'll tell me about them sometime?"

"Certainly," she answered. "We'll have lots of time, Phineas." Her voice had a warmth that went beyond friendship. Slowly, she ate the rest of her sandwich, staring frankly at Kemp. She gulped the rest of her milk, then licked her lips.

Kemp blinked, surprised.

"You know, Phineas, this has been a pretty tense day. How about coming over to my cabin for a drink? There's no reason to end a day like this so dourly."

Her blonde hair shone softly in the light. The invitation gleamed mischievously in her eyes.

Kemp felt uncomfortable. "Why, um, that sounds . . . quite nice, Mikaela."

She stood, and as she walked around the table toward him, he noticed the lines and curves of her body beneath the tight jumpsuit.

She stood behind him and slowly began to rub his shoulders. "We Swedes are famed for massage, you know."

"Ah." Already he could feel his tension dissolving under the graceful touch of her fingers. He chuckled to himself.

"What's so amusing?" Mikaela asked.

"I'm just wondering why you like me, I suppose. I'm not sure I'm so crazy about myself any more."

Mikaela's laughter was musical.

"Dear, dear Phineas. Haven't you guessed? I'm a paleontologist. I've always wanted a dinosaur of my very own."

Phineas Kemp stiffened with indignity for just a moment, and then let it all go with a guffaw. ■

With special thanks to Charles Sheffield.

—The authors

● Always be sincere, whether you mean it or not.
MICHAEL FLANDERS and DONALD SWANN

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brass tacks

Dear Sir:

First, my thanks and congratulations on the serial "Dawn," the first story in years to have me hardly able to wait for the next installment. A most unusual story, with overtones of allegory as well as a suspenseful adventure.

"To Let the Punishment Fit the Crime" is an interestingly conceived editorial. There are two main philosophies of punishment:

1. The retributive, which concerns balancing the punishment against the crime—an eye pays for an eye, a tooth for a tooth—to achieve an abstract cancelling out of the "debt," and

2. The protective, which concerns setting up a mechanism that will best shield the individual (and society) from threats to the person or property.

The first philosophy would fit the punishment to the crime in order to cancel out the criminal's debt to the overall balance of good and evil. It would not, however, achieve the degree of protection that a well-ordered system of graduated punishments would provide. I am thinking of the need for separating nonviolent offenders from the violent types, the sex offenders from the general prison population, the first-offenders from the incorrigibles—and the need to provide progressively tougher penal institutions so that prisoners can be managed by threats of transfer to a less desirable place, and conversely, by hopes of getting "promoted" into one where prisoners have more privileges and better facilities.

Studies have repeatedly shown that *severity* of sentence is a less effective deterrent than the *certainty* and *immediacy*. People refrain from crime when they are fairly sure to be caught, and when punishment will be fairly swift. Our present system falls down on both counts.

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To make apprehension more certain, we need more officers, better training in detection techniques, and better technology. And we need to test out the programs in selected areas before urging their adoption on a wide scale. Once apprehended, the criminal should be tried at the earliest possible opportunity. That means more assistant prosecutors so that cases can be thoroughly prepared without the endless delays of continuances, plus a requirement for early presentation to a court.

To assure real justice and the punishment of the guilty, plea bargaining must be abolished. It only results in the filing of excessive charges as an "asking price," plus the continued incarceration of those who insist on their innocence—as you or I would do if we were falsely charged. The guilty can "cop a plea" and walk out of jail after sentencing to "time served," while the innocent find their cases "continued" interminably while they sit in jail.

Court calendars are clogged because we insist on making everything a crime if we do not approve, rather than limiting our crimes to the really serious acts that threaten individual safety and property. We make the lawyers rich by having laws against things that should be a matter of individual morality. We create criminals by having—and enforcing—a multitude of silly laws, such as the one that led to the arrest of a woman for eating four cashews on a bus. Every time there is any attempt to decriminalize any act, there is a loud outcry from the moralists who want their own morals enforced onto everyone. They are joined by police chiefs who (a) entertain the same values and/or (b) see a lessening of police authority and of the need for police manpower (and womanpower).

I enjoyed Jerry Pournelle's "The Future of Freedom," and am glad to see he does not share the doom views of the Club of Rome and Professor Jay Forrester's "World Dynamics." I have long maintained that we have ample resources for quite a while yet, provided we use our earth technologies to explore and to substitute the more plentiful for the less plentiful materials (or to transform plentiful materials chemically in order to produce scarce ones). If and when we do get into the cargo stage of space transport, the possibilities appear unlimited. As a matter of conserving Earth-space, however, I do subscribe to research in birth control and in providing incentives to the faster-growing populations to practice the techniques science may be able to devise. One major resource which we are using up rapidly is the topsoil, from which we are extracting the nutrients only to flush them into our streams and out to sea via the garbage disposal and the flush toilet, both of which not only waste nutrients irretrievably but pollute our water supplies, as well. We should make every effort to return wastes to the soil, where they can help keep it productive. Soil and water are two resources I do not foresee our bringing to Earth in global quantities, no matter how large our space shuttles may become.

Thank you, again, for making *Analog* so interesting and informative.

RICH FOWLER

Fresno, CA

Dear Stan:

When John W. Campbell Jr. died in 1971, many of his friends and fans asked the U.S. Postal Service to issue a commemorative stamp in his honor. We were informed that the Post Office has a standard procedure of waiting ten years after a person's death before honoring him or her with a stamp. (About the same length of time it takes to get

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a letter delivered, apparently.)

It has been ten years. I suggest that *Analog*'s readers write to their Congresspersons, urging that such a stamp be issued.

BEN BOVA

New York, NY

Excellent idea, and the time is right for more reasons than just those ten years. In the wake of Columbia, *there's new reason to hope that things are really going to happen in space—and we can make a very solid case that John did a* lot *to get us this far.*

Dear Mr. Schmidt,

I thoroughly enjoyed G. Harry Stine's "It's A Big Planet" in the March 30 *Analog*. Mr. Stine is quite right in saying that the world *is* big. I live in Alaska, so I won't argue with him there. And he is right in saying that flying low and slow over the country gives one a new perspective on the environment. But, but . . . I find his flippant attitude on the environment a little disturbing.

"Yeah, we're sure screwing up this planet's ecology, aren't we?" he remarked to Rick Sternbach as they flew over the United States.

You betcha.

The fact that there is still open space in America, that the streams still flow, that the trees are still green, and that, in general, America and the world is not one big slime pit does not mean that all is perfect. I don't think Mr. Stine meant that. I think he meant that from the air it all looked okay. From his view, it probably did. I haven't flown across the United States, the lower 48, in a small airplane, not for great distances. I have looked closely out the window—I always get a window seat—from jets. It didn't look so lovely to me, not on my last trip.

You see, I got *spoiled* by Alaska. And I've flown across Alaska in a small plane. Even from a jet, this state looks a lot different. The first time I flew into Alaska, I flew in at night, under a full moon. Until I got to Anchorage the entire state was just one big hunk of wilderness. No lights. No blazing cities. Few roads. Last summer I flew from Fairbanks to Kaktovik in a DC-3, right over the Brooks Range and the Arctic Circle to the Arctic Ocean. Fifty miles north of Fairbanks civilization ends. I didn't see one damn road, one damn city, just miles and miles and miles of mountains, tundra, and forest. It took three hours by DC-3 to fly to Kaktovik.

In Kaktovik I flew in a Cessna 185 into the William O. Douglas Arctic National Wildlife Range. Except for Kaktovik and a few villages in the range, there are no people. In the 185 I was flying about a thousand feet above the tundra. I could see moose and caribou grazing on the tundra. I could see flocks of wild geese flying below us, casting great silvery shadows on the polygon ice. I could see gyrfalcons circling in the updrafts. But there were no roads, no cities, very few people. It was total virgin wilderness. I had never seen anything like it before. It totally took my breath away, awed me in a way I've never felt. *That's* ecology that hasn't been screwed up. Yet.

I'd invite Mr. Stine to fly up to Alaska. I think he would enjoy it. It's a great state to fly in, and over. I think if Mr. Stine flew over Alaska he might gain another perspective. He might see what real wilderness looks like. He might see what this country looked like when it *was* unspoiled.

Sure, the ecology isn't *totally* screwed up. There's hope. Alaska, at least part of Alaska, will probably remain unspoiled. And I don't think the planet will become totally ravaged unless we

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really work on it. But I know that as long as there is money to be made, people *will* try to screw up this land. I intend to do all I can to stop that, or slow it down. I've seen how this country *did* look from the air. I can't deceive myself the way Stine has. I now know better.

MICHAEL ARMSTRONG

Anchorage, AK

Dear Stan:

I'm organizing an opinion survey of science-fiction and fantasy readers, partly because I suspect the publishing industry has been underestimating the tastes and interests of these readers. I want to discover what they most want and value in their literature. Are book editors serving their needs? If not, what's wrong?

Rather than fill out questionnaires, I hope readers will be willing to express their opinions in their own words. Anyone interested should send me his or her point of view in up to 500 words (typewritten); I will publish a detailed analysis and breakdown of these responses in *The Patchin Review*, my magazine of outspoken criticism and commentary. The most noteworthy essay will be selected by two judges, Norman Spinrad (president of the Science Fiction Writers of America) and Susan Allison (editor at Ace Books); and will be printed in full. The winner will receive $25 plus a 5-year subscription to *The Patchin Review*.

I feel that book publishing usually allows far too little feedback from the consumers (i.e., the readers) to the producers (i.e., the book editors). So here's a chance for readers to make their opinions known. Copies of the opinion poll will be sent to all editors working in the SF/fantasy field.

Each entry must be accompanied by a stamped, self-addressed envelope. Deadline: December 1, 1981. Send to *The Patchin Review*, Dept. A, 9 Patchin Place, New York, NY 10011. Any entrant who also wishes to order a copy of the magazine should enclose $2.50 (includes first-class postage).

CHARLES PLATT

New York, NY

Dear Stan:

I agree with Tom Easton ("The Reference Library," April 27, 1981) that some explanation is needed why our nitrogen-using nitro-life has never been able to make itself felt in the atmospheric equilibrium, but my own smidgin of chemistry prevents me from accepting his explanation. On the most simplistic of grounds, the extremely high-energy triple bond in the N_2 molecule suggests the possibility of fairly energetic reactions; the fact that a great many nitrated organics, and inorganic mixtures containing nitrates, are explosive lends credibility to the suggestion.

Actual calculations for *Nitrogen Fix* were done long ago—I remember talking about some of the results to a college group some time in the winter of '58-'59, and the original work sheets were lost long ago. I know my data source was the *Chemical Rubber Handbook* I had bought my first year of teaching, 1947-48, which had only enthalpies of formation. Tom's review stimulated me to redo the figuring using a more recent data source and, as far as possible, free energies, rather than enthalpies. The values I found and used were:

Aqueous HNO_3	-26.41 kcal/mole
Gaseous CO_2	-94.26 "
Liquid H_2O	-56.56 "
Gaseous NH_3	-3.94 "
Liquid N_2H_4	+12.1 "
Solid glucose	+231.86 "

The last value is a calculation from the heat of combustion and may refer more properly to enthalpy, but I've run

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the following calculations through on both assumptions and don't find enough difference to invalidate the general conclusions.

Glucose in oxygen to carbon dioxide and water, $C_6H_{12}O_6 + 6O_2 \quad 6CO_2 + 6H_2O - 673$ kcal/mole or -3.74/gram of glucose.

Glucose in nitric acid to carbon dioxide, water, and nitrogen, $5C_6H_{12}O_6 + 24HNO_3 \quad 30CO_2 + 42H_2O + 12N_2 - 1146$ kcal/mole -6.36/gram

Ammonia in nitric acid to free nitrogen and water, $5NH_3 + 3HNO_3 \quad 4N_2 + 9H_2O - 87$ kcal/mole -4.82/gram

Hydrazine—I had hoped for more here because of its positive energy of formation, but the higher molar weight cancelled the advantage in energy per gram—$5N_2H_4 + 4HNO_3 \quad 7N_2 + 12H_2O - 126$ kcal/mole -3.96/gram. The hydrazine-nitric acid combination isn't *much* better than glucose and oxygen. But it *is* better per gram of food.

I recognize that all the above need more nitric acid than oxygen per gram of "food." One gram of glucose needs 1.067 of free oxygen or 1.68 of acid; one gram of ammonia needs 3.7 grams of the acid; and one gram of hydrazine needs 1.58 grams of acid. I am not, however, convinced that this is a serious flaw; many organisms—including large ones—seem to be able to adapt to very large differences in concentration of essential chemicals. A 75-kg tarpon at one end of a fishing line can put up a very good argument with a 75-kg human being on the other end over which way the line will go. Both contestants use essentially the same fuel and exactly the same oxidizer, but the tarpon's oxygen is being delivered at about 1 percent the concentration of the human being's (exact value dependent on Gulf Stream temperature, which I don't know). Both, in fact, use as "second wind" the low-energy anaerobic reactions which take glucose to pyruvic acid or alcohol, and which are widely assumed to be the reason the yeast plants didn't make it because they (the reactions) get only about a fifth of the energy from the glucose which oxidation to carbon dioxide and water will extract. (I *did* blow this one in *Needle* thirty-plus years ago; I had an eight-foot shark die from oxygen starvation after the Hunter got into its system. A reader spotted it, of course.)

I have wondered why Earth's nitro-life hasn't taken over as it did in *Nitrogen Fix*. The hypothesis offered in the book—failure of appropriate enzymes ever to come into existence for a reason I won't spoil the story by giving here—is only a suggestion. I consider it chemically believable, but hope I made it obvious that Kahvi was jumping to conclusions. Such aspects of ecological incompatibility as tsetse fly and trypanosome on one side and man and cow on the other may have a bearing—I did imply that once the nitro-life really got started it poisoned the environment with nitrates and nitrites. I was taking for granted that the relatively short common life span of human beings, not to mention Kahvi's poor luck with her children, was a matter of chronic nitrate and nitrite poisoning; I may not have said enough about this in the book, but I have been trying very hard to overcome my nostalgia for the science fiction of the 1930s, in which the story was so often interrupted while the scientist explained to his beautiful but uninformed daughter and her heroic but dumb boy friend how and why everything was happening.

I kept losing track of signs on my calculator in the arithmetic that started this letter, and it is quite possible that I blew something there, though the consistency of results for the different reactions is encouraging. I realize that

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nitric acid is a very corrosive substance to have loose in a living organism; so is the hydrochloric in our stomachs (which I admit is at only about 0.02 molar concentration). I gave no thought to what Bones might have, corresponding to stomach ulcers. In any case, there are lots of less corrosive nitrates, and one gets comparable results doing the calculations with them.

I am absolutely delighted to have a reviewer criticize a book on scientific grounds, even though I disagree with him: I was beginning to fear that the English departments had taken over. Don't let Tom get discouraged by my reaction above; I am not infallible, and he could be right. I'd like to see his calculations.

HAL CLEMENT

Dear Stan and readers:

The L-5 Society is organizing a telephone tree to support the space program. Thousands have joined, and we have coordinators in every state. You do not have to join L-5 Society to get in on the telephone tree. IT'S FREE. Simply write "L-5 Telephone Tree, L-5 Society, 1620 North Park, Tucson, AZ 85719" for details.

In my judgment this is the most crucial time of the century. The current administration is not unwilling to support a vigorous space program, but there are a lot of people who say the public doesn't want space and won't tolerate expenditures on space research. These include, I am sorry to say, some strong advocates of a limited space program of unmanned planetary probes—exactly the wrong way to go, in my judgment. Of course we ought to support planetary science experiments, but as part of a rational program to develop space exploitation, not as ends to themselves.

And if we don't do it now—will we be able to? I don't want to try to scare people, but the Soviets are REALLY getting out into space in a big way—and their performances in Poland, Afghanistan, Czechoslovakia, etc., don't really assure me of their non-aggressive tendencies. But I know it's not fashionable to wave that particular flag.

JERRY POURNELLE

Dear Mr. Schmidt,

Shuttle Down was an original and clever serial, exploring most perceptively the issues raised, and on the whole I enjoyed it. But I'm registering a protest on one detail.

The baloney about Frank's feelings after his tumble with Joyce (in Part 3) I could have passed over as a piece of fantasy for your immature readers ("totally enfolded and cherished"—is this *Analog* or *Teen Confessions*?); but not the suggestion that the affair was something admirable in itself. To readers who regard marriage as sacred (you still have some, though this may surprise you), and who believe that the full development of human love comes through lifelong fidelity and devotion to one partner, the idea that a man "grows up" and becomes a *better* husband by commiting adultery is not only absurd but deeply offensive—far more so than the flippant treatment of sex between casual partners which occurs in so many novels and stories.

I'm not unusually deficient in tolerance and understanding, and I'm certainly not ignorant of the fact that cases of marital infidelity sometimes happen, but when an author instates one of his characters as a "goddess" and makes her preach that they should happen for the good that comes of them, I won't let that pass unchallenged.

Joyce is a remarkable woman and well portrayed as such, but I would have

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thought that even by being clever, knowledgeable, tactful, attractive, and friendly the woman fell rather short of "divine" standard. The morality of a deity with somewhat better credentials strikes me as both more admirable and more realistic than hers.

J. DERRICK MCCLURE
Hilton, Aberdeen, Scotland

Both Lee Correy and I are happily married, and I think I speak for both of us when I say we have a rather high regard for the institution. However, we also recognize that people can have a wide range of views and can be affected in a wide range of ways by almost any experience. I won't tell authors they must limit themselves to a narrow part of that range, and a good author won't try to limit his characters too much.

Dear Stan:

The Reagan Administration has not established a viable space policy even with the success of the space shuttle mission. NASA's planetary sciences program has been further cut back along with the number of shuttle missions planned through 1985, from 48 to 34. However, as reported in *Aviation Week and Space Technology*, 11 May '81, "these capability reductions will be offset somewhat by changes in NASA's planetary launch schedule and Spacelab flight slowdowns." Reading between the lines, obviously, states that there will be fewer planetary missions and greater reductions in expenditures for the planetary sciences.

I cannot overemphasize the vital necessity of active participatory support for pro-space organizations—letters to senators, congressmen, and the President, as well as contributions to pro-space fund groups such as the Viking Fund, the Halley's Comet Fund, and mine, the Solar System Exploration Fund. I will not use any fund monies for advertising in national magazines nor for extensive fundraising efforts for SSEF. My goal is to contribute a minimum of 95 percent of monies received for direct contribution to NASA or to further support pro-space efforts developing the means to establish mining, manufacturing, and colonies in space. Since I am the sole person involved in this effort (the SSEF), no monies will be used for administrative purposes, mailing, or personal use whatever. Some money will be used for printing costs of a quarterly newsletter; all other costs will be paid by me.

February 15th, 1981, marked the first anniversary of the SSEF. A cashier's check for $500, 100 percent of donations received, was mailed to NASA.

NASA does allow for contributions from private groups. Donations must go into NASA's General Services Fund and are allocated to the program with the greatest need. Any donations for a specific program, however, will go to the U.S.A. Treasury. SSEF's contribution will go to NASA's General Services Fund. NASA was quite pleased and grateful for SSEF's efforts.

If you want to contribute to NASA, please make your donation to the Solar System Exploration Fund and send it to Chester Twarog, Chairman, 1943 Paris Street, Aurora, CO 80010. Include a SASE if you want me to acknowledge receipt. If you would include a short letter supporting NASA and why, I will send them to President Reagan. I will send out a quarterly newsletter to each donator describing the current status of the SSEF. The success of NASA's planetary sciences, spacecraft, and eventual industrialization and colonization depends on your active support of a dynamic and progressive space program.

CHESTER TWAROG

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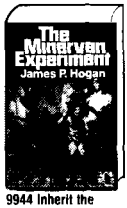

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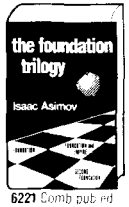

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